Necrotizing Pneumonia

Claudio Karsulovic, Universidad de Chile Year VII
Gillian Lieberman, MD
Our Patient: History (part I)

• 59 year-old male, smoker, no significant past medical history, with recent diagnosis of non-small cell lung cancer.
• He underwent Chemoradiation therapy due to locally advanced disease in mediastinoscopy.
Our Patient: First Chest CT

- Spiculated left hilar mass encasing the distal main left pulmonary artery.
Large, 4 cm FDG avid left hilar mass, with invasion into mediastinal structures
Our Patient: History (part II)

- During 2nd chemoradiation cycle, patient presents to the ED with fever, cough, chills, night sweats and left sided pleuritic pain
- Physical exam is significant for left-sided rales and left chest tenderness to palpation
- Immunocompetent (undergoing chemotherapy)
- A Chest CT was ordered
Chest CT Findings

Let’s see the Chest CT findings in our patient...
Our patient: Summary Index

- Severe Paraseptal Emphysema 🌟
- Cavitation in a large region of left lung concerning for Necrotizing Pneumonia
- Small pneumonic foci in the RUL
- New LLL bronchial inflammation and distal atelectasis
- Stable tumor, predominantly surrounding the left main bronchus
Our Patient: Chest CT
Severe Paraseptal Emphysema

Severe paraseptal emphysema
Our patient: Summary Index

• Severe Paraseptal Emphysema
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Our Patient: Chest CT
Cavitating Consolidation

Consolidation in superior segment of LLL with septated space, containing air and air broncogram
Our patient: Summary Index

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Our Patient: Chest CT
Ground-Glass Infiltrates

Peribronchial ground-glass opacification in the RUL.
Our patient: Summary Index

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Our Patient: Chest CT
Subsegmental Atelectasis

Subsegmental atelectasis in the lateral basal segment, local bronchial inflammation and bronchial wall thickening.
Our patient: Summary Index

- Severe Paraseptal Emphysema ✓
- Cavitation in a large region of left lung concerning for Necrotizing Pneumonia ✓
- Small pneumonic foci in the RUL ✓
- New LLL bronchial inflammation and distal atelectasis ✓
- Stable tumor, predominantly surrounding the left main bronchus ☀
Our Patient: Chest CT

Residual Tumor

Residual peribronchial tumor infiltration in the mediastinum along the left main bronchus
Our patient: Summary Index

- Severe Paraseptal Emphysema ✓
- Cavitation in a large region of left lung concerning for Necrotizing Pneumonia ✓
- Small pneumonic foci in the RUL ✓
- New LLL bronchial inflammation and distal atelectasis ✓
- Stable tumor, predominantly surrounding the left main bronchus ✓

Let’s check out some important Topics...
Our patient: Topic Review

- Severe Paraseptal Emphysema 🌟
- Cavitation in a large region of left lung concerning for Necrotizing Pneumonia
- Small pneumonic foci in the RUL
- New LLL bronchial inflammation and distal atelectasis
- Stable tumor, predominantly surrounding the left main bronchus

Let’s talk a little about different types of Emphysema...
Types of Emphysema: Paraseptal

Features:
• Distal airway
• Along the septae and pleura
• Airflow preserved
• Associated with spontaneous pneumothorax (SP)

History spotlights of SP:
• Young
• Tall
• Thin
• Acute chest pain
Types of Emphysema:
Panacinar

Features:
- Destruction of entire alveolus
- Predominates in lower half of the lungs
- Associated with AAT (alpha 1 antitripsin) deficiency (homozygous)

AAT Deficiency:
- AAT protects Elastin from destruction by Neutrophils’ Elastase
- Without AAT, tissue lose compliance and are more fragile
- Severe form: < 10% of functional enzyme
- Suspect in: Young patient with Cirrhosis + Emphysema
Types of Emphysema: Centriacinar

**Features:**
- Starts in bronchioles and spreads peripherally
- Predominates in upper half of the lungs
- Associated with long-standing cigarette smoking

**Tobacco:**
- Cause airway inflammation increasing neutrophil chemotaxis
- Diminish in Elastin/Elastase ratio
- Accelerated destruction of parenchyma

Let’s continue with our patient findings...
Our patient: Findings Summary

- Severe Paraseptal Emphysema
- Cavitation in a large region of left lung concerning for Necrotizing Pneumonia
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Let’s talk a little about a Cavitating Infective Consolidation...
Cavitating Infective Consolidation: Main Points

Associated most commonly with aspiration

and/or

Impaired local or systemic immune response.

Cavitating Infective Consolidation: Radiological features

- Most commonly: Apicoposterior aspect of the UL or the apical segment of the LL.
- Spherical area of consolidation >2 cm in diameter.
- Usually an air-fluid level present.
- Thick and Irregular wall.
- Abscesses abutting the pleura form acute angles.
- The cavitation does not cross fissures.

Cavitating Infective Consolidation: DDX

<table>
<thead>
<tr>
<th>Necrotizing Infections</th>
<th></th>
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<tbody>
<tr>
<td>Anaerobic bacteria</td>
<td>Staphylococcus aureus, Enterobacteriaceae, Pseudomonas aeruginosa, Legionella, HiB, Nocardia, Actinomycetes</td>
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</tr>
<tr>
<td>Fungi</td>
<td></td>
</tr>
<tr>
<td>Non-Infectious Causes</td>
<td></td>
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<tr>
<td>Bland embolism with infarction</td>
<td></td>
</tr>
<tr>
<td>Vasculitis</td>
<td></td>
</tr>
<tr>
<td>Neoplasm</td>
<td></td>
</tr>
<tr>
<td>Pulmonary sequestration</td>
<td></td>
</tr>
<tr>
<td>Bullae o Cysts with air fluid level</td>
<td></td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td></td>
</tr>
<tr>
<td>Empyema with air fluid level</td>
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</table>
Our patient: Findings Summary

- Severe Paraseptal Emphysema
- Cavitation in a large region of left lung concerning for Necrotizing Pneumonia
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- Stable tumor, predominantly surrounding the left main bronchus

What is the most likely cause in our patient?...
## Our patient: DDX

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### Non-Infectious

#### Ruled Out

We know that our patient has NSCLC under treatment and has presented with fever, chills and productive cough.

Let’s continue with the follow-up...

Claudio Karsulovic, VII
Gillian Lieberman, MD

Bartlett JG. Lung Abscess in: UpToDate, Bartlett JG (Ed), UpToDate, Waltham, MA, 2009
Our Patient: 2 weeks follow-up...
Our Patient: 2 weeks follow-up note

- Not responsive to antibiotics: Vancomycin + Piperacillin-Tazobactam
- Positive Galactomannan
- A follow-up Chest CT was ordered

Let’s see the findings on follow-up images...
Our patient: 2 weeks follow-up Chest CT
Findings Index

• Severe Paraseptal Emphysema 🌟

• Cavitating consolidation

• Ground-glass infiltrates in the RUL
Our Patient: 2 weeks Follow-up Chest CT
Paraseptal Emphysema

Severe paraseptal emphysema
Our patient: 2 weeks follow-up Chest CT
Findings Index

• Severe Paraseptal Emphysema ✓

• Cavitating consolidation 🌟

• Ground-glass infiltrates in the RUL
Our Patient: 2 weeks Follow-up Chest CT
Cavitating Consolidation

Large cavitary lesion with thick wall in the superior segment of LLL with a dense consolidation that extends to the left hilum
Our patient: 2 weeks follow-up Chest CT Findings Index

- Severe Paraseptal Emphysema
- Cavitating consolidation
- Ground-glass infiltrates in the RUL
Our Patient: 2 weeks Follow-up Chest CT
Ground-Glass Infiltrates

Patchy ground-glass infiltrate in the RUL
Our patient: 2 weeks follow-up Chest CT Findings

- Severe Paraseptal Emphysema ✔
- Cavitating consolidation ✔
- Ground-glass infiltrates in the RUL ✔

Let’s review some important points about Necrotizing Pneumonia...
Necrotizing Pneumonia: Summary Index

• Pathophysiology
• Clinical Features
• Radiological Features
• Lung Abscess v/s Necrotizing Pneumonia
• Infectious Causes

Necrotizing Pneumonia: Pathophysiology

Thrombotic occlusion of alveolar capillaries associated with adjacent inflammation, resulting in ischemia and eventually necrosis of the lung parenchyma.

Tumor inside the vessel

Extrinsic compression

Intraluminal thrombus

Necrotizing Pneumonia: Summary Index

- Pathophysiology ✔
- Clinical Features ✪
- Radiological Features
- Lung Abscess v/s Necrotizing Pneumonia
- Infectious Causes

Necrotizing pneumonia: Clinical Features

- Predisposing risk factor, e.g. aspiration or immunocompromised patient
- Cough with purulent sputum.
- Fever.
- Failed response to antibiotics.
- Indolent course of existing pneumonia.
- Pulmonary neoplastic disease or TB infection.

Necrotizing Pneumonia: Summary Index

• Pathophysiology ✓
• Clinical Features ✓
• Radiological Features 🌈
• Lung Abscess v/s Necrotizing Pneumonia
• Infectious Causes

Necrotizing pneumonia: Radiological Features

- Loss of normal pulmonary parenchyma architecture
- Dominant area of consolidation
- Thickened-wall cavitary lesion
- Low contrast enhancing wall of the cavitary lesion

Necrotizing Pneumonia: Summary Index

- Pathophysiology ✓
- Clinical Features ✓
- Radiological Features ✓
- Lung Abscess v/s Necrotizing Pneumonia ⚠
- Infectious Causes

Necrotizing Pneumonia: v/s Lung Abscess

Very controversial topic because for many authors is considered as one entity

<table>
<thead>
<tr>
<th>Necrotizing Pneumonia</th>
<th>Lung Abscess</th>
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</thead>
<tbody>
<tr>
<td>Severe complication causing necrosis of lung parenchyma</td>
<td>Supurative process with a well-defined fibrous wall</td>
</tr>
<tr>
<td>Low contrast enhancing wall in Chest CT</td>
<td>Contrast enhancing wall in Chest CT</td>
</tr>
<tr>
<td>Thick wall &gt; 2 cm with or without air-fluid level</td>
<td>Thick wall &gt; 2 cm, with air-fluid level</td>
</tr>
<tr>
<td>Loss of normal lung parenchyma</td>
<td>Normal pulmonary parenchyma architecture</td>
</tr>
</tbody>
</table>

Necrotizing Pneumonia: Summary Index

- Pathophysiology ✓
- Clinical Features ✓
- Radiological Features ✓
- Lung Abscess v/s Necrotizing Pneumonia ✓
- Infectious Causes ✷

Necrotizing Pneumonia: Infectious causes

Anaerobes
Most common cause
Associated with aspiration

Aerobes
• MRSA
  Associated with Panton Valentine Leukocidine (PVL)
  Present as a community-acquire pathogen in the US
• E.Coli
• S.Pneumoniae
• Pseudomona aeruginosa
Necrotizing Pneumonia: Summary Index

- Pathophysiology ✓
- Clinical Features ✓
- Radiological Features ✓
- Lung Abscess v/s Necrotizing Pneumonia ✓
- Infectious Causes ✓

Let’s continue with our patient’s history...

Our Patient: 3 weeks follow-up...
Our Patient: 3 weeks follow-up note

• Change of antibiotic therapy to: Ceftriaxone 2 gr Q24 + Metronidazol 500 mg Q8
• Antifungal coverage with: Voriconazol 300 mg twice daily
• Stable clinical condition
• A follow-up Chest X Ray was ordered

Let’s see the findings on the follow-up X ray…
Our patient: 3 weeks follow-up Chest X Ray
Findings

• Large medial lucencies (Severe Emphysema)

• Cavitating consolidation

• Focal opacity in the RUL
Large medial lucencies (Severe Emphysema)

- Large thin-walled areas of lucency in the anterior chest corresponding to large areas of bullous disease.
Our patient: 3 weeks follow-up Chest CT Findings

- Large medial lucencies (Severe Emphysema) ✓
- Cavitating consolidation ★
- Focal opacity in the RUL
Our patient: 3 weeks follow-up Chest X Ray

Cavitating consolidation

- Large lucent lesion demonstrating a thick rim of increased opacity, situated in the superior segment of the LLL
Our patient: 3 weeks follow-up Chest CT
Findings

• Large medial lucencies (Severe Emphysema) ✓

• Cavitating consolidation ✓

• Focal opacity in the RUL 🟢
Our patient: 3 weeks follow-up Chest X Ray

Focal opacity in the RUL

- Focal opacity in the left lower lung and the right mid lung.

Do you remember the “Spine Sign”?
Our patient: “Spine Sign”

But, what finally happened with our patient?
**Our patient: Final DDX**

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<td>Mycobacteria</td>
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<td>Possible: Positive Galactomannan and indolent evolution</td>
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<td>Fungi</td>
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<tr>
<td>Non-Infectious</td>
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</table>

**Ruled Out**

We know that our patient has NSCLC under treatment and he has infectious symptoms

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Gillian Lieberman, MD

Bartlett JG. Lung Abscess in: UpToDate, Bartlett JG (Ed), UpToDate, Waltham, MA, 2009
Our Patient: 3 weeks follow-up note

- Stable clinical condition
- Slow improvement with new therapy
- Follow-up with Pulmonary and Infectious Disease teams for monitoring and serial imaging
Acknowledgements

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• Scott Zimmer, MD
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• Our webmaster: Larry Barbaras
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