North Carolina SPICE
Statewide Program for Infection Control & Epidemiology

INFECTION MANAGEMENT AND Antibiotic Stewardship

Hot Topic Session #10:

Equivocal Chest X-rays in Nursing Homes

February 28, 2024

North Carolina Clinical Antibiotic Stewardship Partners

Conflict of interest Disclosures

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- These slides contain materials from a variety of colleagues including CDC, WHO, AHRQ, etc.

Outline of today's session

1. Talk about Pneumonia
2. Review guidelines for diagnosis of pneumonia
3. Discuss CXR role and reads
4. Discuss principles for antibiotic stewardship in PNA

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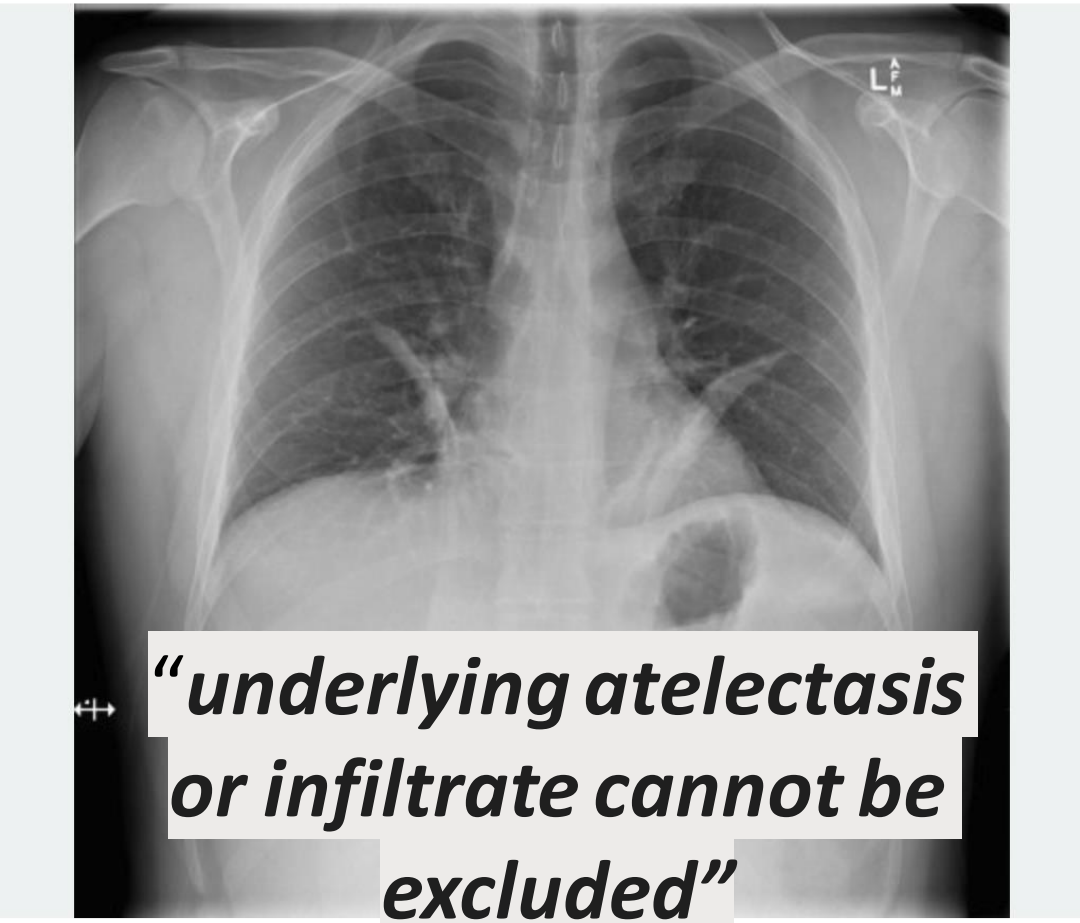
The Case of Mrs. M

- Mrs. M is an 83 yo F living in your facility. She has a history of htn, COPD, and dementia. She is noted to have a new cough which has developed over the past few days. The provider on call overnight ordered a chest X-ray which was read as:



Pneumonia

- A leading cause of morbidity and mortality in nursing home residents.
- Differential is broad:
  - Bacterial
    - Klebsiella, Streptococcus
  - Viral
    - COVID, Flu
  - Aspiration

Antibiotic Stewardship around Pneumonia

- From the standpoint of antibiotic stewardship, the challenge is differentiating bacterial pneumonia from other respiratory illnesses.

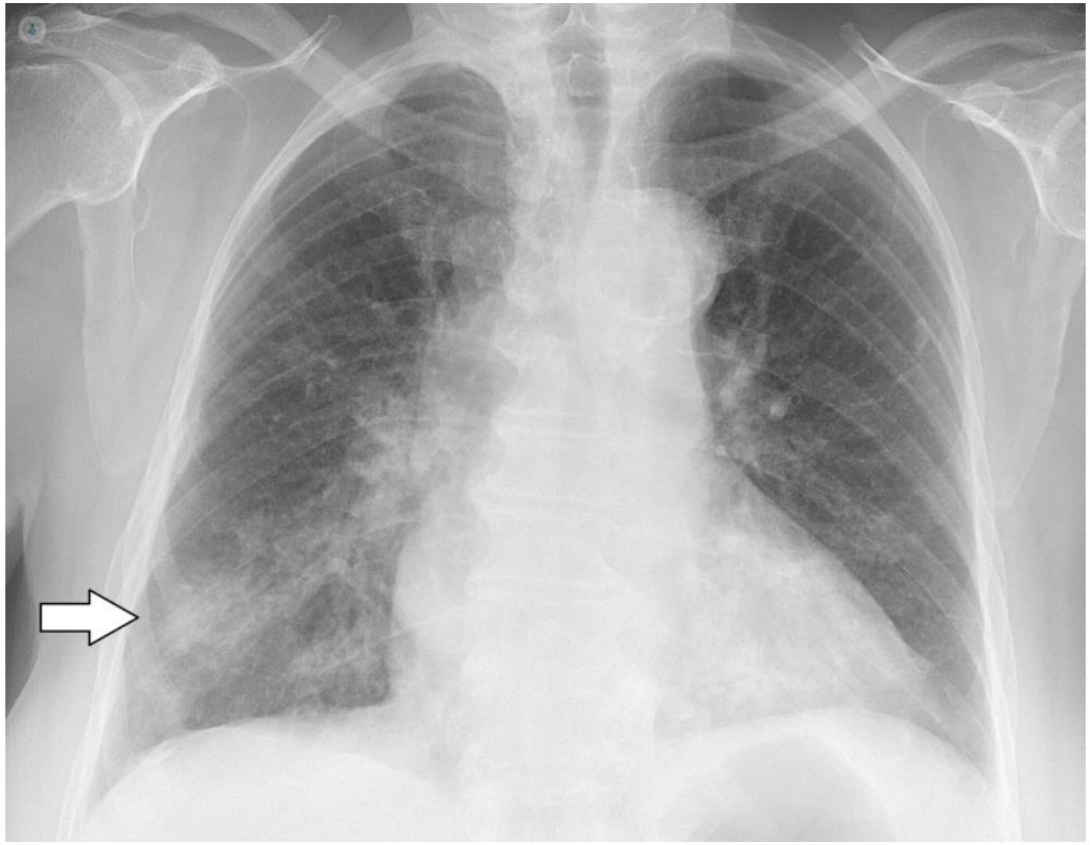
- In NH residents, pneumonia frequently presents without typical symptoms such as fever, cough, or dyspnea.

- Several guidelines have been promulgated to help improve the precision of clinical diagnoses of pneumonia, most of which include results of a chest radiograph as a cornerstone of diagnosis.

Chest X-Rays and Pneumonia

- Chest x-ray evidence is considered a key diagnostic criterion for pneumonia by the Infectious Disease Society of America (IDSA) diagnostic guidelines, the modified McGeer diagnostic criteria, and the Loeb criteria for initiating antibiotics

- However, x-ray interpretation is often equivocal.



IDSA Guidelines

IDSA/ATS Minor Criteria	Simplified Minor Criteria	Modified Minor Criteria
Confusion	Confusion	Confusion
Uremia	Uremia	Uremia
Respiratory rate ≥30 breaths/min	Respiratory rate ≥30 breaths/min	Respiratory rate ≥30 breaths/min
Hypotension	$PaO_2/FiO_2 \leq 250$ mmHg	$PaO_2/FiO_2 \leq 250$ mmHg
$PaO_2/FiO_2 \leq 250$ mmHg	Multilobar infiltrates	Multilobar infiltrates
Multilobar infiltrates		Age ≥65 years
Leukopenia		
Thrombocytopenia		
Hypothermia		

IDSA/ATS = Infectious Disease Society of America and the American Thoracic Society. PaO_2/FiO_2 = arterial oxygen pressure/fraction inspired oxygen.

Modified McGeer Criteria

SITE/INFECTION	DATE	CRITERIA	COMMENTS
Respiratory Tract/Common Cold		**Two or more:** • Runny nose or sneezing, • Stuffy nose, hoarseness, or difficulty swallowing, • Dry cough, or • Swollen or tender glands in the neck	Symptoms must be acute and not allergy related. Fever not required but does not exclude diagnosis.
Sinusitis		Diagnosis by a physician or practitioner	
Influenza-like illness (ILI)		**Fever (>38C or 100.4F) and two or more:** • Chill, • Headache or eye pain, • Myalgia (muscle aches), • Sore throat, or • Dry cough	Symptoms must be acute. Usually during influenza season; generally, November through March
Pneumonia		**Both:** • Interpretation by a radiologist of a chest X-ray as demonstrating pneumonia, probably pneumonia or the presence of a new infiltrates with a compatible clinical syndrome, and • At least two symptoms as described under lower respiratory tract infections.	Non-infectious causes must be ruled out (e.g., Congestive Heart Failure)
Other Lower Respiratory Tract Infection		**Three or more:** • New or increased cough, • New or increase sputum production, • Fever (>38C or 100.4F), • Pleuritic chest pain, or • New physical findings on chest exam (rales, wheezing, bronchial, breathing).	Symptoms must be acute. Either no chest X-ray done, or X-ray does not meet the definition for pneumonia above.

Loeb Criteria

Lower respiratory tract infection *with temp >38.9 °C (102 °F)*	At least one of the following criteria □ Productive cough □ Respiratory rate >25 breaths / minute
with temp >37.9 °C (100 °F) or 1.5 ºC (2.4 ºF) above baseline	Both of the following criteria □ Cough, AND □ At least one of the following criteria □ Pulse >100 beats / minutes □ Rigors □ Delirium □ Respiratory rate >25 breaths / minute
afebrile with COPD and >65 years old	Both of the following criteria □ New or increased cough □ Purulent sputum production
afebrile without COPD	All of the following criteria □ New cough □ Purulent sputum production □ At least one of the following criteria □ Delirium □ Respiratory rate >25 breaths / minute
with new infiltrate on chest X-ray consistent with pneumonia	At least one of the following criteria □ Productive cough □ Respiratory rate >25 breaths / minute □ Temp >37.9 °C (100 °F) or 1.5 °C (2.4 °F) above baseline

Note: *Consider ordering chest X-ray and CBC with differential for febrile residents with cough and any of these criteria (HR >100, worsening mental status, or rigors)*

Antibiotics should not be used for up to 24 h after large-volume aspiration in those without COPD but with temp ≤38.9ºC (102 ºF) and non-productive cough

Zoom Poll

- Which one of these guidelines or criteria do you use?

Type in the Chat:

- McGeer
- IDSA
- Loeb
- Other

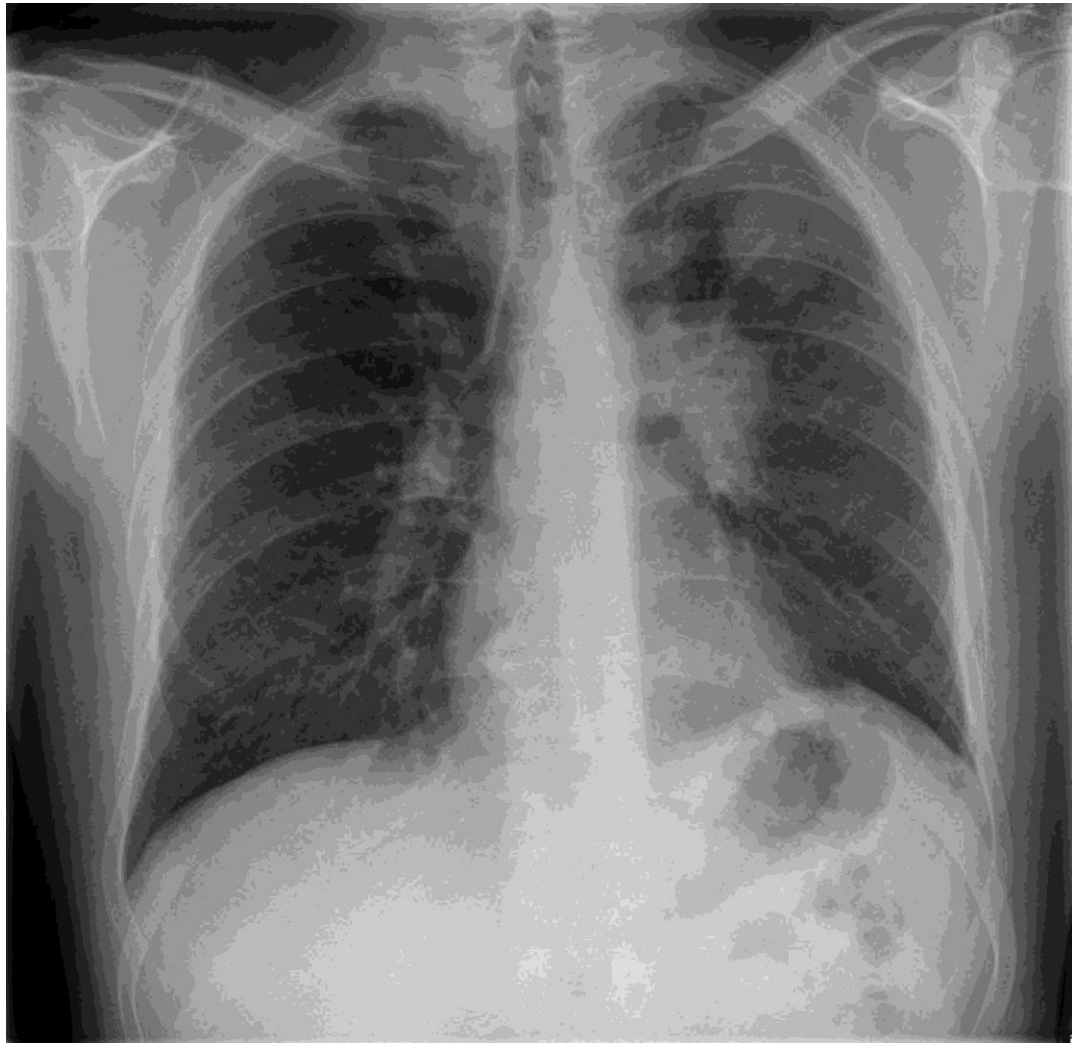
- How are your Chest X-rays obtained and resulted?

Type in the Chat:

- Portable?
- Sent off site?
- Hospital based?
- How long to get back?

Ambiguous Readings

- Why?
- High prevalence of chronic illness and disability in the NH population leads to difficulty with positioning
  - Frailty
  - contractures
  - arthritis
  - osteoporotic kyphosis
  - Pain
  - cognitive impairment



Common Wording with Ambiguous Results

Atelectasis without pneumonia	**Identifies atelectasis without mention of possibility of pneumonia:** terms included linear opacities, streaky opacities, right lower lobe atelectasis, atelectasis at lung bases, possible atelectasis, likely atelectasis	Low Likelihood of Pneumonia
Cannot exclude pneumonia	**Pneumonia is not likely but cannot be excluded:** terms included pneumonia could be missed, pneumonia not excludable, pneumonia would be considered, may reflect pneumonia, suggesting pneumonia, infiltrate may not be seen, possible infiltrate	Intermediate Likelihood of Pneumonia
Atelectasis or pneumonia	**Reports both pneumonia/infiltrate and atelectasis as possibilities:** terms included patchy atelectasis or pneumonitis, patchy atelectasis or interstitial pneumonitis, may reflect atelectasis or pneumonia, pneumonia vs. atelectasis, infiltrate vs. atelectasis, consistent with atelectasis or developing acute infiltrate, underlying atelectasis or infiltrate cannot be excluded, right lower lobe atelectasis or infiltrate	Intermediate Likelihood of Pneumonia
Infiltrate without pneumonia	**Infiltrate is identified without use of the word pneumonia:** terms included possible infiltrate suggested, right lower lung infiltrate, right base infiltrate, minimal infiltrate persists, infiltrate and linear atelectasis in both, bilateral lower lobe infiltrates with linear atelectasis	Intermediate Likelihood of Pneumonia

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So what do we do? Treat it all?

- No!
- Unfortunately though, in many cases providers treat ambiguous x-ray reports as if they are definitive for pneumonia
- And even more concerning, in one study a third of those with negative x-ray reports were still treated

McClester Brown M, Sloane PD, Kistler CE, Reed D, Ward K, Weber D, Zimmerman S. Evaluation and Management of the Nursing Home Resident With Respiratory Symptoms and an Equivocal Chest X-Ray Report. J Am Med Dir Assoc. 2016 Dec 1;17(12):1164.e1-1164.e5. doi: 10.1016/j.jamda.2016.09.012. Epub 2016 Nov 1. PMID: 27815108.

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Be an Antibiotic Steward!

- Based on expert-based guidelines, antibiotic stewardship efforts should encourage clinicians to rely more on clinical signs and symptoms and to not rush to prescribe antibiotics in patients who lack clinical signs of pneumonia—regardless of the chest x-ray result.

- Specifically, antibiotic treatment should be reserved for patients who experience clinical signs and symptoms that are worrisome for bacterial infection.

Metlay J, Kapoor W, Fine M. Does this patient have community-acquired pneumonia? Diagnosing pneumonia by history and physical examination. JAMA 1997;278:1440e1445.

Hollaar V, Maarel-Wierink C, van der Putten G, et al. Defining characteristics and risk indicators for diagnosing nursing home-acquired pneumonia and aspiration pneumonia in nursing home residents, using the electronicallymodified Delphi Method. BMC Geriatr 2016;16:60

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Be an Antibiotic Steward!

- Fever greater than 100.4°F
- Purulent sputum
- Increased respiratory rate (>25 beats/min)
- New or worsening cough
- Change in mental status
- Vital sign instability
  - *Key to determining the need for antibiotics or for careful observation.*

Antibiotic Stewardship

- Vital signs and physical exam have been shown to be **95% sensitive** in diagnosing pneumonia
  - In the setting of normal vitals and physical exam, neither an x-ray nor an antibiotic should be necessary if close follow-up is available!

- Eight clinical variables (increased pulse, respiratory rate >30 beats/min, temperature >38°C, somnolence or decreased alertness, presence of acute confusion, lung crackles on auscultation, absence of wheezes, and increased white blood count) will identify NH patients with a high probability of having pneumonia without a chest x-ray.

- D. Mehr, E. Binder, R. Kruse, *et al.* Clinical findings associated with radiographic pneumonia in nursing home residents. J Fam Pract, 50 (2001), pp. 931-937

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Final Question

- Is this a practice changer for your facility?

Educational Materials to Post in your Work Area

- Find session materials https://spice.unc.edu -> NC Clasp -> Nursing Homes

Does Pneumonia Require Antibiotics? The answer may be "no".

Expert guidelines encourage clinicians to rely on clinical signs and symptoms and to not rush to prescribe antibiotics in patients who lack clinical signs of pneumonia–regardless of the chest x-ray result.

Is it Pneumonia?

- A conclusive chest X-ray, AND
- At least two:
  - New or worsening cough
  - New or increased sputum
  - Fever
  - Pleuritic chest pain
  - New chest exam findings (rales, rhonchi, wheezing, bronchial breathing)
  - New/increased shortness of breath OR respiratory rate >25/min
  - Change in mental status
  - Vital sign instability

However, Chest X-rays...

- Can be difficult to get due to problems with positioning.
- The resulting X-ray may be hard to interpret conclusively.
- Ambiguous X-rays are not definitive for pneumonia.

Antibiotics should be reserved for patients with **clinical signs and symptoms** that are worrisome for **bacterial** pneumonia.

Questions and Discussion