Assessment of Guideline-Concordant Testing for *Legionella pneumophila* and *Streptococcus pneumoniae* in Community-Acquired Pneumonia

Waleed Malik, MD[1], Ann Fisher, MD[1,2], Brian Kotansky, PharmD[2], Louise Dembry, MD[1,2], Rupak Datta, MD, PhD[1,2]
[1] Yale School of Medicine, New Haven, CT, USA
[2] Veterans Affairs Connecticut Healthcare System, West Haven, CT, USA

Background

- Community-acquired pneumonia is a leading cause of morbidity and mortality in the US
- Recent IDSA/ATS guidelines recommend urine antigen testing for *Streptococcus pneumoniae* and *Legionella pneumophila* only in patients with severe pneumonia
- We evaluated the utility of urine antigen testing for *S. pneumoniae* and *L. pneumophila* to improve quality of care at one institution

Questions

- Did patients who had a *S. pneumoniae* or *L. pneumophila* antigen test ordered meet IDSA/ATS criteria for testing?
- Did patients receive guideline-concordant therapy for pneumonia based on severity?

Patient has ***one of the following*** found in two or more serial chest imaging test results[1,2,14]:
Either new and persistent **OR** progressive and persistent
• Infiltrate
• Consolidation
• Cavitation
• Pneumatoceles, in infants ≤ 1 year old
AND Patient has at least ***one*** of the following:
• Fever (> 38.0°C or > 100.4°F)
• Leukopenia (≤ 4,000 WBC/mm^3)
• Leukocytosis (≥ 12,000 WBC/mm^3)
• Adults ≥ 70 years old, altered mental status with no other recognized cause
AND Patient has at least ***two*** of the following:
• New onset of purulent sputum[3] or change in character of sputum[4], or increased respiratory secretions, or increased suctioning requirements
• New onset or worsening cough, or dyspnea, or tachypnea[5]
• Rales[6] or bronchial breath sounds
• Worsening gas exchange (for example: O_3 desaturations (for example, $PaO_2/FiO_2 \leq 240$)[7], increased oxygen requirements, or increased ventilator demand)

Figure 1: 2021 NHSN PNU1 Criteria

Methods

- Retrospective cohort study, 9/2018-9/2021
- Included patients with urinary antigen test for L. pneumophila and S. pneumoniae within 3 days of admission
- Evaluated for the presence of pneumonia defined based on NHSN criteria (Figure 1)
- Guideline-concordant therapy was assessed based on ATS/IDSA guidelines (Figure 2)
- Selected comorbidities based on the 2019 IDSA/ATS CAP guidelines included heart disease, lung disease, malignancy, chronic kidney disease, alcoholism, liver disease, and asplenia

Validated definition includes either one major criterion or three or more minor criteria

Minor criteria
Respiratory rate ≥ 30 breaths/min
Pa_{O2}/Fi_{O2} ratio ≤ 250
Multilobar infiltrates
Confusion/disorientation
Uremia (blood urea nitrogen level ≥ 20 mg/dl)
Leukopenia* (white blood cell count < 4,000 cells/μl)
Thrombocytopenia (platelet count < 100,000/μl)
Hypothermia (core temperature < 36°C)
Hypotension requiring aggressive fluid resuscitation

Major criteria
Septic shock with need for vasopressors
Respiratory failure requiring mechanical ventilation

Figure 2: 2007 ATS/IDSA criteria for defining severe CAP

Results

- 352 patients had urinary antigen test (341 *Legionella pneumophila*, 222 *Streptococcus pneumoniae*) collected within 3 days of admission
- 64% (n=127) met criteria for pneumonia, with only 7% (n=25) meeting criteria for severe pneumonia
- Among patients with severe pneumonia (n=25), none had a positive urine *L. pneumophila* test, and two had a positive urine *S. pneumoniae* test
- Overall, there were 9 positive tests for *S. pneumoniae* and 1 for *L. pneumophilia* during study period
- 61% of patients with non-severe pneumonia and 52% of patients with severe pneumonia received guideline-concordant therapy (Table 1)
- 5% of patients had prior isolation of MRSA and 4% of patients with *Pseudomonas aeruginosa* (Table 2)

Outcomes	Severe, N (%)	Non-Severe, N (%)	None, N (%)
Diagnostic			
Legionella urine antigen	25 (100)	100 (98)	216 (96)
S. pneumoniae urine antigen	21 (84)	70 (69)	132 (59)
Respiratory pathogen PCR panel	24 (96)	89 (87)	191 (85)
Sputum culture	20 (80)	54 (53)	137 (61)
Therapeutic			
Guideline-concordant therapy	13 (52)	62 (61)	78 (35)
Duration of Therapy			
<=5	8 (32)	44 (43)	72 (32)
>5	17 (68)	58 (57)	153 (68)

Table 1: Diagnostic and therapeutic characteristics of veterans according to presence of pneumonia, N=352

Variable	N (%)
Age, years	
<65	74 (21)
≥65	278 (79)
Male sex	342 (97)
White	301 (86)
Hispanic ethnicity	16 (5)
Selected Comorbidities	
Heart Disease	268 (76)
Lung Disease	203 (58)
CKD	55 (16)
Diabetes Mellitus	106 (30)
Malignancy	115 (33)
Prior Isolated Bacteria	
MRSA	16 (5)
Pseudomonas	13 (4)

Table 2: Descriptive characteristics of study cohort

Conclusions

- Most patients did not meet ATS/IDSA criteria for *L. pneumophila* or *S. pneumoniae* urine antigen testing
- Diagnostic stewardship interventions for CAP are needed to reduce unnecessary testing
- Evidence-based order sets may help to improve outcomes in CAP with guideline-based diagnostics and therapy

Acknowledgements

Hospital Epidemiology and Infection Prevention Program at the Veterans Affairs CT Healthcare System
Yale School of Medicine, Section of Infectious Diseases