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Local validation of the drug resistance in pneumonia clinical predication score at a large academic medical center and a community hospital

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Introduction & Background

- Pneumonia (PNA) is the primary infectious cause of death in the United States
- With antibiotic resistance rising, there is a clinical incentive to identify risk factors associated with drug-resistant pathogens (DRPs)
- The 2005 American Thoracic Society/Infectious Diseases Society of America (ATS/IDSA) established the health care-associated pneumonia (HCAP) criteria to identify patients at risk for DRP in community acquired pneumonia (CAP)
- HCAP criteria overestimated risk, increasing inappropriate broad-spectrum use
- The 2019 ATS/IDSA CAP guidelines do not recommend use of the HCAP criteria, leaving an unmet clinical demand for a novel risk stratification tool
- Webb et al. derived and validated the drug resistance in pneumonia (DRIP) score, which demonstrated better predictability for identifying patients at higher risk of DRPs compared to HCAP criteria, without increasing rates of inadequate coverage and reduction in empiric broad-spectrum therapy

Purpose

- The purpose of this analysis was to achieve local validation of the DRIP score at Massachusetts General Hospital (MGH) and Newton-Wellesley Hospital (NWH), an academic medical center and community hospital, respectively

Methods

Design
- Retrospective chart review of adult (≥18 years old) patients admitted to the MGH or NWH emergency department (ED) from May 2017 to May 2019, who received antibiotics for a documented diagnosis of CAP

Inclusion Criteria
- Clinical and radiographic evidence of PNA
- Microbiological report (culture or urinary antigen) within 48 hours of ED presentation has growth of a bacterial respiratory pathogen with sensitivities

Exclusion Criteria
- Lack of positive, speciated microbiological evidence of PNA with sensitivities
- Alternative/uncertain diagnosis or source; fungal, viral, excluded pathogen (*Neisseria* spp., *Enterococcus* spp., coagulase-negative S*taphylococcus spp.)*
- Cystic fibrosis or prior lung transplant

Primary Outcome:
- Validation of the DRIP score at MGH and NWH for predicting DRPs in CAP

Secondary Outcome:
- Compare sensitivity, specificity, positive and negative predictive value (PPV, NPV) of the DRIP score versus the HCAP criteria
- Describe the most common isolated pathogens from patients presenting with CAP
- Describe the percentage of patients with CAP due to a DRP

Statistical Analysis
- Descriptive statistics, sensitivity, specificity, PPV, and NPV used to compare data

Results

Table 1: DRIP Score Risk Assessment

Major Risk Factors	
Antibiotic use in previous 60 days	2
Residence in a long-term care facility	2
Tube feeding	2
Infection with a DRP within previous 1 year	2
Minor Risk Factors	
Hospitalization within previous 60 days	1
Chronic pulmonary disease	1
Poor functional status *	1
Gastric acid suppression **	1
Wound care	1
MRSA colonization within previous 1 year	1
High risk DRP = DRIP score ≥ 4	

* Karnofsky score <70% or non-ambulatory status
** Use of a proton pump inhibitor or H_2 blocker in last 14 days

Figure 1: Pathogen Speciation

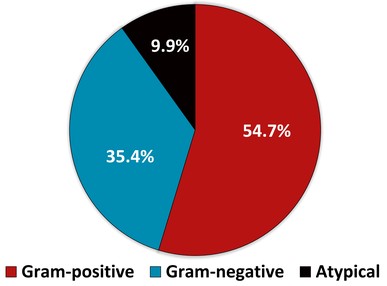

Table 2. Baseline Characteristics (n=164)

Baseline Demographics	
Sex – no. male (%)	99 (60.4)
Age (years) – median (IQR)	70 (59.0-81.3)
Weight (kg) – median (IQR)	72.7 (62.6-85.2)
PSI Class – no. (%)	
Class I-II	29 (17.7)
Class III	37 (22.6)
Class IV	66 (40.2)
Class V	32 (19.5)
CURB-65 Score – median (IQR)	2 (1.0-2.0)
Co-morbidities – no. (%)	
Chronic pulmonary disease	92 (56.1)
Chronic renal insufficiency	35 (21.3)
Congestive heart failure	36 (22.0)
Diabetes mellitus	36 (22.0)
Poor functional status	35 (21.3)
Active malignancy	33 (20.1)
Additional medical history – no. (%)	
Long term care/nursing facility	21 (12.8)
Hemodialysis	8 (4.9)
Tube feeding	14 (8.5)
Home infusions	11 (6.7)
Gastric acid suppression	63 (38.4)
Immunosuppression	33 (20.1)
Risk Score & Resistance – no. (%)	
DRIP score ≥ 4	54 (32.9)
Positive HCAP	104 (63.4)
DRP isolated	50 (30.5)

Table 3. Predictability of the DRIP score vs. HCAP criteria

Validation Study (Risk Tool)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
MGH + NWH (DRIP Score)	**0.74** (0.59-0.85)	**0.85** (0.77-0.91)	**0.68** (0.54-0.80)	**0.88** (0.80-0.93)
Webb, et al. (DRIP Score)	**0.82** (0.67-0.88)	**0.81** (0.73-0.87)	**0.68** (0.56-0.78)	**0.90** (0.81-0.93)
MGH + NWH (HCAP Criteria)	**0.82** (0.68-0.90)	**0.45** (0.36-0.54)	**0.39** (0.29-0.44)	**0.85** (0.73-0.92)
Webb, et al. (HCAP Criteria)	**0.79** (0.67-0.88)	**0.65** (0.56-0.73)	**0.53** (0.42-0.63)	**0.86** (0.77-0.92)

Results

- 3,053 patients were screened for inclusion and majority 64% (1,955/3,053) were excluded due to a lack of microbiological speciation or sensitivities
- In total, 164 patient encounters were randomly selected for inclusion
- The most common pathogens isolated were gram positive organisms, most notably *Staphylococcus aureus* (29.8%) and *Streptococcus pneumoniae* (24.9%)
- Of all patients with CAP, 30.5% (50/164) of patients grew a DRP on cultures, of which 74% (37/50) had a DRIP score ≥ 4 and 26% (13/50) had score < 4
- A total of 33% (54/164) patients had a DRIP score ≥ 4 of which 31% (17/54) did not isolate a DRP in comparison the HCAP criteria identified 63% (104/164) at risk for DRP of which 61% (63/104) did not isolate a DRP

Limitations

- Exclusion criteria required an extensive screening process for inclusion, primarily driven by a lack of positive microbiologic cultures with speciation and sensitivities
- Past medical history was restricted to that in the EMR and the study did not capture information about all other patient encounters from external health systems
- The electronic report generated for screening came from antibiotic orders with a documented diagnosis of pneumonia, potentially bypassing inclusion of pneumonia if the antibiotic order was associated with a diagnosis of sepsis or blood stream infection

Conclusions & Future Direction

Conclusions
- These results further validate the DRIP score derived by Webb, et al. in predicting DRPs in CAP
- Our findings warrant further evaluation to assess if the DRIP score risk stratification tool reduces inappropriate broad-spectrum antibiotic use for CAP at MGH or NWH

Future Direction
- A larger prospective analysis of the DRIP score will be performed by implementing the risk stratification tool into the electronic medical record (EMR) ordering system in the MGH and MWH emergency departments
- A future analysis is warranted to compare the DRIP score to the current recommendations via the 2019 IDSA CAP Guidelines for patients at risk for DRPs

References

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Disclosures

The authors have nothing to disclose concerning possible financial or personal relationship with commercial entities that may have a direct or indirect interest in the subject matter.