Application of the DRIP Score at a Veterans Affairs Hospital

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We commend Webb and colleagues on the development of the drug resistance in pneumonia (DRIP) clinical prediction score (1). The DRIP score performed better than other published prediction scores in terms of most accurately identifying drug-resistant pathogens (DRPs), thereby limiting unnecessary use of broad-spectrum antibiotics (1–8). We share our institution's assessment of the DRIP score in DRP identification and broad-spectrum antibiotic use to illustrate the importance of its local validation.

We aimed to examine the effect of adoption of the DRIP score on broad-spectrum antibiotic use at the Salt Lake City Veterans Affairs Medical Center (VAMC), an academically affiliated VAMC supervised by a hospitalist service and an active antimicrobial-stewardship program (ASP). During the study period, there was no institution-specific standardized decision algorithm to guide antibiotic selection for pneumonia. There is a concerted effort to employ antimicrobial-stewardship-minded prescribing among house staff, hospitalists, and intensivists, as fostered by the training program curriculum and the facility's ASP. The hospitalist group has consistent informal discussions with members of the ASP about management approaches to common disease. Additionally,

TABLE 1 Patient characteristics^a

Characteristic	Values for all patients (n = 170)	Values for patients with a DRIP score of ≥4 (n = 45)
Age (yr)	73 (66–84)	74 (65–82)
No. (%) of males	168 (99)	45 (100)
No. (%) admitted to intensive care unit	41 (24)	16 (36)
No. (%) intubated	11 (7)	4 (9)
No. (%) on vasopressors	3 (2)	1 (2)
Total antibiotic duration (days) (range)	6 (5–7)	7 (5–7)
No. (%) with CAP-DRP	3 (2)	2 (4)
No. (%) positive/tested for <i>Streptococcus pneumoniae</i> urinary antigen	8/128 (6)	2/33 (6)
No. (%) positive/tested for <i>Legionella pneumophila</i> urinary antigen	1/129 (1)	0/33
No. (%) positive/tested by respiratory culture	11/48 (23)	3/14 (21)
No. (%) positive/tested by blood culture	6/153 (4)	1/41 (2)
No. (%) retreated for pneumonia (within 30 days)	9 (5)	2 (5)
No. (%) exhibiting mortality within 30 days	16 (9)	11 (24)
No. (%) exhibiting in-hospital mortality	5 (3)	3 (7)
No. (%) readmitted (within 30 days)	24 (15)	6 (14)
Length of stay (days) (range)	4 (3–6)	4 (3–7)

^aAbbreviations: DRIP, drug resistance in pneumonia; CAP, community-acquired pneumonia; DRP, drug-resistant pathogen. Data are expressed as medians (interquartile ranges) or numbers (percentages).

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TABLE 2 Proportion of patients receiving broad-spectrum antibiotics

Group ^a	No. who received broad-spectrum antibiotics	% who received broad-spectrum antibiotics	95% confidence interval
All patients (<i>n</i> = 170)	28	16.5	11.2–22.9
DRIP score of ≥ 4 (<i>n</i> = 45)	20	44.4	29.6–60.0
HCAP score of ≥ 1 (<i>n</i> = 82)	25	30.5	20.8–41.6

^aAbbreviations: DRIP, drug resistance in pneumonia; HCAP, health care-associated pneumonia.

each team has a dedicated clinical pharmacist who evaluates the appropriateness of prescriptions. Finally, the ASP performs prospective auditing and feedback of target antimicrobials each weekday, with feedback provided to teams on stewardship rounds.

By retrospective, manual chart review, we reviewed 170 hospitalized patients between March 2016 and February 2017 with an ICD-10 diagnosis of pneumonia present on admission, for which they received antibiotics. Data collected included the DRIP score, health care-associated pneumonia (HCAP) criteria, antibiotics received, microbiology, acute severity of illness measures, and outcomes. We compared actual antibiotic selection with potential changes, assuming that a DRIP score of ≥ 4 would have led to use of a broad-spectrum antibiotic (1). Twenty-six percent (45/170) of patients had a DRIP score of ≥ 4 (Table 1). A DRP was isolated in 2% (3/170) of patients. All three patients with a DRP fulfilled one or more HCAP criteria, and 2/3 had DRIP scores of ≥ 4 . Sixteen percent (28/170) of patients received broad-spectrum antibiotics defined as antipseudomonal beta-lactams (Table 2). Strict DRIP score adherence for all patients would have led to a 13% increase and a 4% decrease in antibiotic use, resulting in a net 9% increase in empirical broad-spectrum antibiotic use. In the subset of patients with a DRIP score of ≥ 4 , DRIP adherence would have led to a 49% increase in empiric broad-spectrum antibiotic use. Our primary goal was to assess the potential impact of the DRIP score on antibiotic selection; however, we calculated the performance characteristics of usual care, defined as a clinician's decision to use community-acquired pneumonia (CAP) antibiotics rather than broad-spectrum antibiotics (Table 3), HCAP criteria (Table 4), and the DRIP score (Table 5) for predicting CAP-DRP among the patients (*n* = 161) from whom cultures were collected. There was no apparent difference in in-hospital mortality (4% versus 10%, *P* = 0.6), 30-day mortality (16% versus 35%, *P* = 0.14), 30-day readmission (13% versus 17%, *P* = 1.0), 30-day pneumonia retreatment (8% versus 0%), and hospital length of stay (4 days versus 5.5 days, *P* = 0.3) in patients with a high DRIP score who received community-acquired pneumonia versus broad-spectrum antibiotics, respectively. We highlight that this assessment's primary intent was not to evaluate outcomes and was likely underpowered. Finally, application of the DRIP score was more selective than HCAP criteria, as the latter would have led to a 31% net increase in broad-spectrum antibiotic use in all patients versus the 9% noted above.

Our findings suggest that the DRIP score may lead to increased broad-spectrum antibiotic use without improving clinical outcomes in the setting of active antimicrobial-stewardship efforts, infrequent empirical broad-spectrum use for CAP, and low rates of DRPs. Institutions using HCAP criteria may consider the DRIP score as a means of reducing

TABLE 3 Performance of usual care for predicting CAP-DRP^a

CAP-DRP status	No. positive	No. negative
Patients who received broad-spectrum antibiotics	2	24
Patients who received the usual antibiotics for CAP	1	134

^aThe patients tested (*n* = 161) included patients from whom blood cultures, respiratory cultures, *Streptococcus pneumoniae* urinary antigen results, and/or *Legionella pneumophila* urinary antigen results were obtained. CAP, community-acquired pneumonia; DRP, drug-resistant pathogen. The percent sensitivity (95% confidence interval) of the assay was 66.7% (9.4 to 99.2%), and its percent specificity (95% confidence interval) was 84.8% (78.2 to 90.0%). The positive predictive value (95% confidence interval) was 7.69% (0.9 to 25.1%), and the negative predictive value (95% confidence interval) was 99.3% (95.9 to 100%).

TABLE 4 Performance of HCAP criteria for predicting CAP-DRP^a

CAP-DRP status	No. positive	No. negative
Patients with an HCAP score of ≥ 1	3	76
Patients with an HCAP score of < 1	0	82

^aThe patients tested ($n = 161$) included patients from whom blood cultures, respiratory cultures, *Streptococcus pneumoniae* urinary antigen results, and/or *Legionella pneumophila* urinary antigen results were obtained. Abbreviations: HCAP, health care-associated pneumonia; CAP, community-acquired pneumonia; DRP, drug-resistant pathogen. The percent sensitivity (95% confidence interval) of the assay was 100% (29.2 to 100%), and its percent specificity (95% confidence interval) was 51.9% (43.8 to 59.9%). The positive predictive value (95% confidence interval) was 3.8% (0.8 to 10.7%), and the negative predictive value (95% confidence interval) was 100% (95.6 to 100%).

TABLE 5 Performance of DRIP criteria for predicting CAP-DRP^a

CAP-DRP status	No. positive	No. negative
Patients with a DRIP score of ≥ 4	2	41
Patients with a DRIP score of < 4	1	117

^aThe patients tested ($n = 161$) included patients from whom blood cultures, respiratory cultures, *Streptococcus pneumoniae* urinary antigen results, and/or *Legionella pneumophila* urinary antigen results were obtained. Abbreviations: DRIP, drug resistance in pneumonia; CAP, community-acquired pneumonia; DRP, drug-resistant pathogen. The percent sensitivity (95% confidence interval) of the assay was 66.7% (9.4 to 99.2%), and its percent specificity (95% confidence interval) was 74% (66.5 to 80.7%). The positive predictive value (95% confidence interval) was 4.65% (0.6 to 15.8%), and the negative predictive value (95% confidence interval) was 99.2% (95.4 to 100%).

broad-spectrum antibiotic use. Our assessment underscores the need for local validation of the DRIP score before its widespread incorporation, as well as large-scale comparisons of clinical outcomes in patients with high DRIP scores treated with broad- versus narrow-spectrum antibiotics.

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