Combining DRIP Score and Rapid Diagnostics For Improved Antibiotic Stewardship

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Introduction

- Critically ill patients with pneumonia are frequently placed on broad-spectrum antibiotics even if they have few or no risk factors for antibiotic resistance
- Physicians feel uncomfortable not covering for the most resistant organisms in patients requiring intubation
- In general, these patients are changed from a typical community-acquired pneumonia regimen to cover MRSA and *Pseudomonas aeruginosa*.
- Unfortunately, guidance based on CAP vs HCAP vs HAP has not shown particular success in patients at risk.
- The DRIP score (Drug Resistance in Pneumonia) is an attempt to risk in these patients based on clinical history (Table 1).
- Several hospitals who have implemented the DRIP score report significantly lower use of broad-spectrum antibiotics without negative consequences.
- There is still significant overuse of broad-spectrum antibiotics even when the DRIP score is utilized.
- By combining the DRIP score with rapid diagnostics we can significantly lower broad-spectrum antibiotic beyond what DRIP alone is capable of.
- The DRIP score can become a tool for diagnostic stewardship, reducing the overuse of expensive molecular testing.

Aims and Objectives

- Using the cohort of patients from the Unyvero clinical trial, calculate a DRIP score for each patient.
- Compare the predictive value of the DRIP Score when using culture as the comparator to the DRIP Score when using Unyvero LRT as the comparator.
- Compare the predictive value of a modified DRIP scoring system which adds in the Unyvero LRT data when compared to the culture results.

Methods

- For the 442 patients with data available from the Unyvero LRTI registrational trial, calculate a DRIP score.
- Since this is a retrospective cohort if data is missing a $DRIP_{Max}$ and $DRIP_{Min}$ will be calculated imputing the maximum or minimum value for missing data. For the subset of patients with all data available a standard DRIP score is calculated. A score of ≥4 indicates high risk for the presence of a drug resistant pathogen.
- We make the assumption that a patient placed on broad-spectrum antibiotics will receive vancomycin and an anti-pseudomonal initially and the anti-atypical antibiotic is generally stopped.
- We compare the ability of the DRIP scores to result in appropriate antibiotic choice vs overly broad antibiotic choice to the Unyvero LRTI panel. We then add an algorithm (Fig 1) for combining the two and determine the ability of the DRIP score to lead to diagnostic stewardship for LRTI.

Results

Characteristic	# of points
Major risk factors:	
Antibiotic use within previous 60 days	2
Residence in a long-term-care facility	2
Tube feeding	2
Prior infection with a DRP (1 year)	2
Minor risk factors:	
Hospitalization within previous 60 days	1
Chronic pulmonary disease	1
Poor functional status	1
Gastric acid supression	1
Wound care	1
MRSA colonization	1

Table 1: DRIP Score Contributing Factors

Acinetobacter spp.	Moraxella catarrhalis
Chlamydia pneumoniae	Moraxella pneumonia
Citrobacter freundii	Mycoplasma pneumonia
Enterobacter cloacae complex	Pneumocystis jirovecii
Escherichia coli	Proteus spp,
Haemophilus influenzae	Pseudomonas aeruginosa
Klebsiella oxytoca	Serratia marcescens
Klebsiella pneumonia	Staphylococcus aureus
Klebsiella variicola	Stenotrophomonas maltophilia
Legionella pneumonia	Streptococcus pneumoniae

Table 2: Unyvero LRTI Targets

	Additional Resistant Organisms Detected	
DRIP≥4	ESBL Producer	15
	Acinetobacter	13
	Carbapenem Resistant Acinetobacter	9
	KPC Producer	2
	Legionella	2
	Mycoplasma	1
	Stenotrophomonas maltophilia	38
		80
DRIP<4	ESBL Producer	1
	Acinetobacter	1
	Carbapenem Resistant Acinetobacter	0
	KPC Producer	0
	Legionella	0
	Mycoplasma	1
	Stenotrophomonas maltophilia	7
		10

Table 3: Other Antibiotic Resistant Organisms Detected by Unyvero

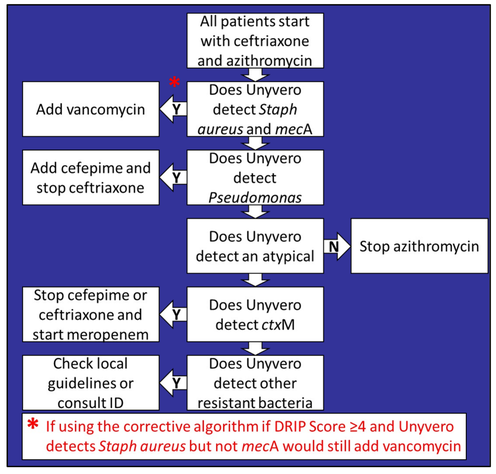
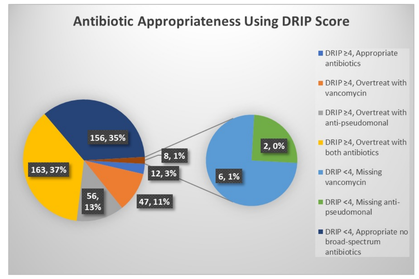
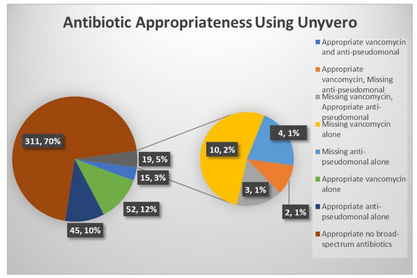
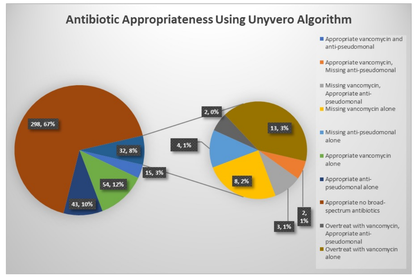
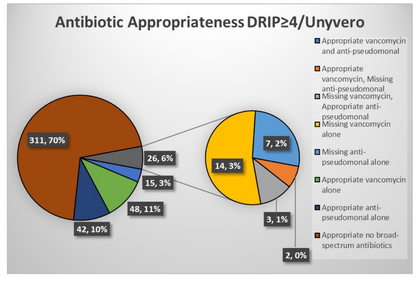


Figure 1: Unyvero Interpretive Algorithm









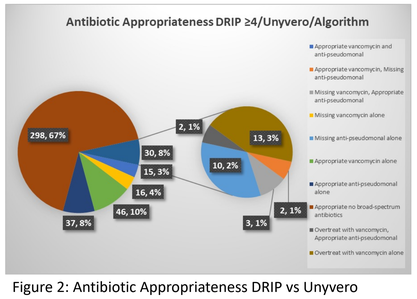


Figure 2: Antibiotic Appropriateness DRIP vs Unyvero

DRIP Complete		Sens	Spec
DRIP Alone	MRSA or Pseudomonas	0.91	0.58
	MRSA	0.88	0.50
	Pseudomonas	0.95	0.51
Unyvero and Algorithm	MRSA or Pseudomonas	0.89	0.98
	MRSA	0.87	0.98
	Pseudomonas	0.94	1.00
DRIP ≥4, Unyvero	MRSA or Pseudomonas	0.79	1.00
	MRSA	0.76	1.00
	Pseudomonas	0.87	1.00
DRIP ≥4, Unyvero and Algorithm	MRSA or Pseudomonas	0.81	0.98
	MRSA	0.80	0.98
	Pseudomonas	0.87	1.00
$DRIP_{Max}$		**Sens**	**Spec**
DRIP Alone	MRSA or Pseudomonas	0.93	0.49
	MRSA	0.92	0.43
	Pseudomonas	0.97	0.43
Unyvero and Algorithm	MRSA or Pseudomonas	0.87	0.95
	MRSA	0.87	0.96
	Pseudomonas	0.91	1.00
DRIP ≥4, Unyvero	MRSA or Pseudomonas	0.80	1.00
	MRSA	0.79	1.00
	Pseudomonas	0.87	1.00
DRIP ≥4, Unyvero and Algorithm	MRSA or Pseudomonas	0.81	0.95
	MRSA	0.82	0.96
	Pseudomonas	0.87	1.00
$DRIP_{Min}$		**Sens**	**Spec**
DRIP Alone	MRSA or Pseudomonas	0.85	0.63
	MRSA	0.82	0.56
	Pseudomonas	0.90	0.56
Unyvero and Algorithm	MRSA or Pseudomonas	0.87	0.98
	MRSA	0.87	0.98
	Pseudomonas	0.91	1.00
DRIP ≥4, Unyvero	MRSA or Pseudomonas	0.74	1.00
	MRSA	0.73	1.00
	Pseudomonas	0.81	1.00
DRIP ≥4, Unyvero and Algorithm	MRSA or Pseudomonas	0.75	0.98
	MRSA	0.76	0.98
	Pseudomonas	0.81	1.00

Table 4: Performance of Diagnostics and Algorithms

Conclusions

- Imputing the highest value for missing data in the DRIP score to derive $DRIP_{Max}$ increased sensitivity, decreased specificity, and increased negative predictive value and led to fewer missed pathogens.
- While the $DRIP_{Max}$ allows for a significant reduction in overuse of broad-spectrum antibiotics it is non-specific and still leads to overuse of the combination of vancomycin and an anti-pseudomonal.
- Using the Unyvero LRTI rapid diagnostic is more targeted as it identifies specific pathogens including MRSA and *Pseudomonas*. This allows for reduction in overuse of broad-spectrum antibiotics where only vancomycin or an anti-Pseudomonal antibiotic is used.
- The Unyvero LRTI also finds specific pathogens and specific resistances which require antibiotics outside of just vancomycin and anti-pseudomonals.
- There is a significant cost to applying the Unyvero LRTI to every potentially eligible patient. Since the $DRIP_{Max}$ has a very high negative predictive value, running the Unyvero LRTI only patients who have a $DRIP_{Max}$ ≥4 will catch nearly all the patients with resistant bacteria.
- Using $DRIP_{Max}$ in our cohort of 442 patients would have led to 6 cases where MRSA was missed, 2 cases where *Pseudomonas* was missed, but 210 cases of overtreatment with vancomycin and 219 cases of overtreatment with an anti-pseudomonal
- Using Unyvero in our cohort of 442 patients would have led to 13 cases where MRSA was missed and 6 cases where *Pseudomonas* was missed but no overtreatment. It also picked up 8 cases of MRSA and 8 cases of *Pseudomonas* missed by culture and 90 additional pathogens that would modify treatment further.
- Restricting use of the Unyvero to only those patients with a $DRIP_{Max}$ ≥4 led to 17 missed cases of MRSA and 9 missed cases of *Pseudomonas* and missed 10 of the additional pathogens but reduced the number of Unyvero runs by 164.
- Unyvero is excellent for Antibiotic Stewardship while restricting it to DRIP score ≥4 is excellent for Diagnostic Stewardship.

References

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Acknowledgements

Thank you to the Embark program directors with special thanks to Dr. Dwayne Baxa.