Clinical and Pharmacoeconomic Impact of Rapid Diagnostic Pneumonia Panel in Patients Admitted with Nosocomial Pneumonia

Kathryn Kerr, PharmD[1]; Nikunj Vyas, PharmD, BCPS[1]; Cindy Hou, DO, MA, MBA, FACOI, FACP[2]

[1]Department of Pharmacy, Jefferson Health - New Jersey, Cherry Hill, NJ; [2]Department of Infectious Diseases, Jefferson Health – New Jersey, Cherry Hill, NJ

Purpose

The purpose of this study was to evaluate the clinical outcomes of patients who received the BioFire® FilmArray ® Pneumonia Panel (BFPP), and to evaluate the pharmacoeconomic impact of BFPP to review its potential cost-effectiveness.

Background

- Nosocomial pneumonia is a significant cause of mortality in critically ill patients. It is associated with an 11.1% mortality rate,[1] and is the most common healthcare-associated infection.[2]
- To improve patient outcomes, causative organisms need to be rapidly identified and antibiotic therapy must be tailored.
- BFPP provides accurate pathogen identification within one hour, testing bronchoalveolar lavage (BAL) and sputum specimens.

Methods

- BFPP group was defined and test was conducted on patients with nosocomial pneumonia from January—February 2019.
  - BFPP was restricted to infectious disease service to be offered only to critically ill patients.
  - BFPP group was matched with a comparator group on a 2:1 ratio, based on age, renal function, diagnosis, and Charlson Comorbidity Index. Comparator group data was collected from October—December 2019.
- Inclusion criteria were defined as:
  - Age ≥ 18 years
  - Diagnosis of nosocomial pneumonia (HAP & VAP
  - Admitted for at least one day
- Patients excluded if they were pregnant
- Primary outcome was to assess clinical cure, defined as:
  - Resolution of signs and symptoms consistent with infection; and
  - Radiographic improvement; and
  - Expression of clinical cure by an infectious disease
- Secondary outcomes included assessing inpatient mortality, and assessing incidence and time to escalation, de-escalation, or discontinuation of antibiotics.
- Pharmacoeconomic analysis was performed, evaluating cost of therapy in hospitalization.

Results

Table 1. Patient Demographics

	BFPP	COMPARATOR	P value
AGE (Median, range)	70 (31-95)	65 (21-83)	NS
GENDER (% Female)	38.5%	61.5%	0.01
ICU ADMISSION (% Yes)	80.8%	84.6%	NS
MORTALITY (% Yes)	26.9%	46.2%	0.27

Figure 1: Clinical Cure

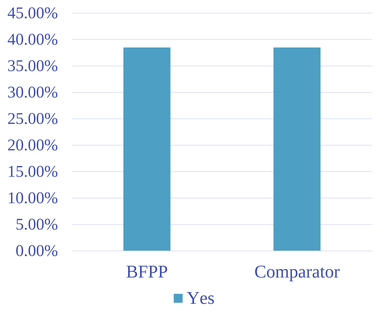

Figure 2: Action Taken at PCR / Culture & Sensitivity

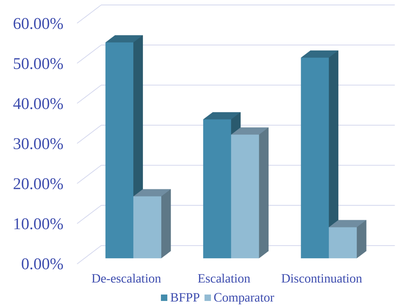

Table 2: Secondary Endpoints

	BFPP	COMPARATOR	P VALUE
TIME TO ACTION TAKEN AT IDENTIFICATION (Median, range), Hours	24 (6-168)	48 (24-120)	0.01

Table 3: Mortality Analysis

	BFPP			COMPARATOR		
	Alive (N = 19)	Deceased (N = 7)	P value	Alive (N = 7)	Deceased (N = 6)	P value
PITT BACTEREMIA SCORE (Median, range)	2 (0-14)	6 (0-12)	0.03	2 (0-4)	8 (6-12)	0.05
PNEUMONIA SEVERITY INDEX (Median, range)	104 (36-219)	127 (61-177)	0.02	132 (105-152)	160 (118-191)	0.02
CHARLSON COMORBIDITY INDEX (Median, range)	4 (0-11)	4 (0-12)	NS	4 (0-7)	4 (1-8)	NS

Table 4: Resistance Review

	BFPP			COMPARATOR		
	Alive (N = 19)	Deceased (N = 7)	P value	Alive (N = 7)	Deceased (N = 6)	P value
RESISTANCE DETECTED (%)						
ESBL	17.5%	11.8%	0.21	40.0%	33.3%	NS
MRSA	15.0%	5.9%	0.01	0.0%	8.3%	NS
KPC	0.0%	0.0%	NS	0.0%	0.0%	NS
None	67.5%	82.4%	0.03	60.0%	58.3%	NS

Table 4. Pharmacoeconomic Analysis

	BFPP Patients (N=26)	Non-BFPP Patients (N=13)	P value
Biofire instrument cost/assay	$3,500	$0.00	
Total cost of hospital stay	$286,000	$243,705	0.60
Total Cost of Therapy	$289,500	$243,705	
Total cost of ICU care	$144,000	$175,000	0.032

Discussion

- Patients in the BFPP group were matched with comparator group, however the comparator group had higher severity of illness.
- No difference was seen in clinical cure between two study groups; however, we noticed shorter amount of time to antimicrobial stewardship (ASP) intervention in BFPP group.
- Moreover, overall number of ASP interventions were higher in BFPP group, with most common actions taken being de-escalation and discontinuation of antibiotics.
- Consistent with the literature, patients who suffered from mortality were found to have higher severity of illness compared to patients who lived.
- Though no difference in inpatient mortality was observed, we noticed trends towards fewer patients suffering from mortality in BFPP group.
- No difference was seen in cost of hospitalization and therapy, however overall cost of ICU care was lower in BFPP.
- Limitations include small sample size, retrospective chart review, and single center study

Conclusions

- Based on this study, there is no association between clinical cure and inpatient mortality with utilization of the BFPP.
- Utilization of BFPP was associated with faster time to and increased number of ASP interventions.
- It has value in promoting ASP efforts in facilitating de-escalation and discontinuation of antibiotics while providing cost benefit in ICU patients.
- Larger studies are needed to further evaluate impact on clinical outcomes.

References

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2. Magill SS, O'Leary E, Janelle SJ, et al. Changes in Prevalence of Health Care-Associated Infections in U.S. Hospitals. *N Engl J Med.* 2018 Nov 1; 379(18): 1732-1744. doi: 10.1056/NEJMoa1801550
3. The BioFire® FilmArray® Pneumonia (PN) Panel. https://www.biofiredx.com/products/the-filmarray-panels/filmarray-pneumonia/