Assessing the impact of the meningitis/encephalitis diagnostic panel on antimicrobial stewardship

Jonathan Garellek[1], Thien-Ly Doan[2], Shawn Varghese[3], Rebecca Schwartz[4], Rehana Rasul[5], and Henry Donaghy[1]

(1) Department of Medicine, Division of Infectious Diseases, Long Island Jewish Medical Center, Northwell Health, Hofstra Northwell School of Medicine, Manhasset, NY, (2) Department of Pharmacy, Long Island Jewish Medical Center, New Hyde Park, NY, (3) Department of Medicine, Long Island Jewish Medical Center, New Hyde Park, NY, (4) Department of Occupational Medicine, Epidemiology and Prevention, Feinstein Institute for Medical Research, Manhasset, NY
(5) Biostatistics Department, Feinstein Institute for Medical Research, Manhasset, NY

Contact information
Thien-Ly Doan
tdoan@northwell.edu
Tel – (718) 470-7428
Fax – (718) 470-7595

INTRODUCTION

- The multiplex polymerase chain reaction (PCR) assay for meningitis/encephalitis (ME) is available to detect 14 pathogens from the cerebral spinal fluid (CSF) in less than 2 hours
- Common practice for meningitis is to empirically initiate patients on antimicrobials which can sterilize cultures, however PCR should not be affected
- PCR technology has the potential to be useful to help curb antimicrobials (e.g., antibiotics, antivirals) and to promote antimicrobial stewardship whether positive or negative

STUDY OBJECTIVES

- To assess whether patient care is improved after PCR implementation with oversight from the antimicrobial stewardship program (ASP) team
  - Time to de-escalation of empiric therapy (e.g., negative and positive PCR)
  - Total days of therapy of antimicrobials
  - Hospital length of stay, attributable mortality rate, and readmission rate

METHODS

- Conducted an IRB-approved, single center retrospective cohort study
- Random sample of patients between 7/2015 to 12/2018 where the intervention group included those with a ME panel result whereas control group without ME result were matched to seasonality
- Data was collected using electronic medical records (e.g., demographics, culture & PCR results, antimicrobials administered, occurrence of adverse events, length of stay (LOS), mortality)

Inclusion criteria
- Subjects suspected to have meningitis or encephalitis, aged 18 years of and greater with cerebral spinal fluid sent for analysis

Exclusion criteria
- Subjects that did not receive any antimicrobial therapy

Statistical analysis
- Frequency and percent of patient characteristics were calculated and differences between PCR and no PCR groups were assessed using Fisher's exact test
- Median and interquartile range of continuous variables were calculated and assessed using the Mann Whitney Rank Sum test

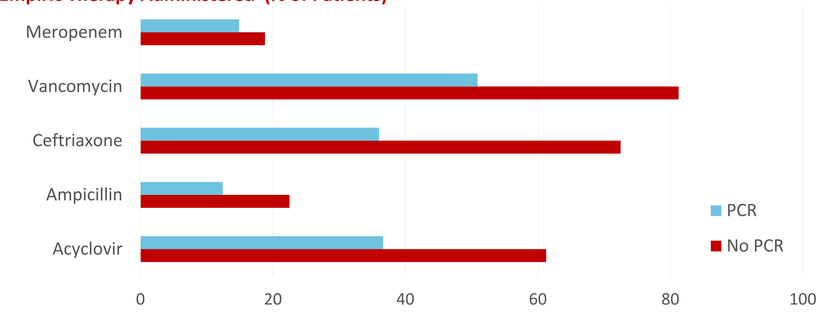
RESULTS

Baseline Characteristics* N = 241	No PCR, n = 80 n (%)	PCR, n = 161 n (%)
Sex		
Male	38 (47.5)	82 (50.9)
Age		
Range in years	18 – 89	18 – 99
Mean in years	45.7	54.8
Race		
African American	30 (37.5)	55 (34.2)
Caucasian	14 (17.5)	48 (29.8)
Asian	13 (16.3)	32 (19.9)
Other	23 (28.8)	26 (16.1)
Comorbidities		
HIV	7 (8.8)	6 (3.7)
Chronic kidney disease	6 (7.5)	17 (10.6)
Immunosuppression	8 (10.0)	16 (9.9)
Diabetes	17 (21.3)	44 (27.3)
Malignancy	4 (5.0)	15 (8.7)

* No statistical differences between groups, with exception for HIV

Diagnostics and Treatment	No PCR, n = 80 n (%)	PCR, n = 161 n (%)
Etiology of meningitis identified	2 (2.5)	17 (10.6)
Prior antibiotic used in past 2 weeks	15 (18.8)	17 (10.5)
Antibiotics given prior to lumbar puncture	48 (60.0)	95 (58.6)

Empiric Therapy Administered (% of Patients)



Primary Outcomes – Results N = 241	No PCR n = 80	PCR n = 161	P-value
Time to de-escalation in hours, median [IQR]	64.62 [37.2 – 83.3]	43.06 [26.9 – 47.7]	P < 0.004
Total days of therapy, median [IQR]	2 [1 – 4]	4 [1 – 7]	P = 0.121
Median hospital length of stay in days, median [IQR]	5.5 [3 – 8.5]	9 [6 – 15]	P < 0.004
Readmissions, n (%)	13 (16.3)	23 (13.7)	P = 0.592
Mortality, n (%)	3 (3.8)	14 (8.6)	P = 0.161

STUDY LIMITATIONS

- Standard group (non-PCR) only provides a historical, rather than contemporaneous control
- Some events of interest were not frequent, therefore we were not able to adjust for known risk factors that may influence them
- Time for de-escalation analysis was performed only in those that survived

CONCLUSIONS

- The ME PCR in conjunction with ASP efforts were associated with earlier time to de-escalation of antimicrobials
- There was a higher rate of pathogen diagnosed in the PCR group which could explain the longer median length of stay
- Earlier de-escalation has the potential to decrease costs associated with broad-spectrum agents as well as a potential decrease incidence of adverse drug events (e.g., *Clostridioides difficile* infection)