High Prevalence of Multidrug Resistant Organisms: MRSA, VRE, CRE, ESBLs and *C. difficile* at a Chicago LTACH

Ruby Barza, MLS(ASCP)[1], Kodi Wyant, MD[1], Parul Patel, MLS(ASCP),CCRP[1], Jignesh Patel, PhD[1] , Katherine Mendoza, B.A[1], Kathy A Mangold, PhD[1], Natali Chavez, MLS(ASCP)[1], Kihe Kim, RN[2], David Hines Jr., MD[3] and Kamaljit Singh, MD[1]

[1]Department of Pathology and Laboratory Medicine, NorthShore University HealthSystem, Evanston, IL;
[2]Kindred Hospital Chicago North, Chicago, IL; [3]Infectious Diseases, Metro Infectious Disease Consultants, Burr Ridge, IL

Ruby Barza, MLS(ASCP)
Department of Infectious Disease Research
NorthShore University HealthSystem
Evanston, Illinois
RBarza@northshore.org

Poster # 416

Background

Long-term acute care hospitals (LTACHs) are health care facilities that admit complex patients with acute care needs and multiple co-morbidities which place them at risk of colonization with Multidrug-Resistant Organisms (MDROs) including Carbapenem Resistant *Enterobacteriaceae* (CREs).[1] There are few data available on rates of MDRO colonization (and co-colonization of CRE carriers with other MDRO) in LTACHs. Active screening for MDROs is an integral part of infection control interventions and has been shown to effectively decrease MDRO infection rates.[2] Our institution was invited to perform a point-prevalence screening for MDROs at a Chicago LTACH to support the infection control program and to determine if enhanced infection control measures have had a significant impact on MDRO colonization. We conducted a point-prevalence study of CRE's, Extended spectrum B-lactamases producing *Enterobacteriaceae* (ESBLs), Vancomycin resistant *Enterococci* (VRE), Methicillin resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* (Cdif) carriage among patients at the LTACH in April 2017. The goal was to determine MDRO carriage rates and to isolate and prevent spread of MDROs.

Materials and Methods

Specimens:

- Two rectal specimens were collected to screen for CRE, ESBL, VRE and Cdif :
  - 1 double-headed Copan Transystem® with Liquid Stuart (Copan Diagnostics INC)
  - 1 FecalSwab (Copan Diagnostics INC)
- Anterior nasal swab was collected to detect MRSA :
  - 1 double-headed Copan Transystem® with Liquid Stuart (Copan Diagnostics INC)

PCR Testing :

Cepheid Xpert® *C. difficile/Epi* (Cepheid Cdif):

- 400uL of sample from FecalSwab transport tube was transferred into the elution reagent tube and vortexed at high speed for 10 seconds
- The entire elution reagent was then transferred to the specimen chamber in the GeneXpert® cartridge
- Real-time PCR was performed by using GeneXpert® Dx instrument (Cepheid, Inc., Sunnyvale, CA) in accordance with the Cepheid Xpert® C. difficile/Epi assay's package insert

Cepheid Xpert® Carba-R (Cepheid Carba-R):

- Another 400uL of sample from FecalSwab transport tube was transferred into the elution reagent tube and vortexed at high speed for 10 seconds
- The contents of the elution reagent tube were transferred using the transfer pipette provided (approximately 1.7 mL) into specimen chamber of the Xpert Carba-R cartridge
- Real-time PCR was performed by using GeneXpert® Dx instrument (Cepheid, Inc., Sunnyvale, CA) in accordance with the Cepheid Xpert® Carba-R assay's package insert

Methods Cont'd

In house *PCR for bla$_{KPC}$/bla$_{NDM}$*

- Real-time PCR detection of bla$_{KPC}$ and bla$_{NDM}$ was performed using a modification of a previously published method[3]
- One of the double-headed rectal swabs (Copan Transystem) was broken off into 10mL of Trypticase Soy Broth with 30ug ceftriaxone disk and incubated overnight at 35 ˚C
- After incubation, 250µL of the overnight incubated enrichment broth was added to 200µL of lysis buffer and heated at 99 ˚C for 10 minutes
- The buffer was centrifuged briefly and 1µL of the supernatant was used for real-time PCR on a LightCycler 96 System (Roche Diagnostics, Indianapolis, IN). The primers, probes, and PCR parameters to amplify bla$_{KPC}$ and bla$_{NDM}$ as well as a 16S internal control were combined into a single amplification reaction as previously described [3]

Culture Testing

MDRO Culture:

- A 10uL of sample from Fecalswab transport tube was plated directly onto HardyCHROMagar™ ESBL (Hardy Diagnostic, Santa Maria, CA) agar
- Plates were incubated at 33-35˚C for up to 24 hours
- After incubation, plates were examined for pink, blue and tan colonies with a brown halo (Table 1) and subcultured to a Blood Agar Plate (BAP) for isolation
- Identification of suspected organisms were performed using MALDI-TOF (BD Bruker) and susceptibility testing performed by Kirby-Bauer disk test following CLSI guidelines
- The list of an antibiotic-containing disks tested are shown in Table 2
- Phenotypic testing for ESBL detection was performed using Cefotaxime and Cefotaxime-clavulanate disks and Ceftazidime and Ceftazidime-clavulanate disks as per CLSI recommendation

MRSA Culture:

- One of the double-headed anterior nasal swabs (Copan Transystem) was used to plate directly onto CHROMagar™ MRSA (BBL, Becton Dickinson, Sparks, MD) agar
- Plates were incubated at 33-35˚C for up to 24 hours
- Presence of mauve colonies were consider positive for MRSA

VRE Culture:

- One of the double-headed rectal swabs (Copan Transystem) was plated directly onto Columbia Naladixic Acid (CNA) agar with vancomycin disks
- Plates were incubated at 33-35˚C for 18-24 hours
- Plates were examined for alpha hemolytic colonies around the vancomycin disk and presumptive colonies were subcultured to BAP
- Identification of suspected colony type was performed by MALDI-TOF
- Only *E. faecalis* and *E. faecium* were reported as VRE

Results

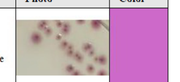
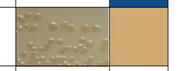
- 81 patients were eligible for the study; 6 declined so a total of 75 patients were included in data analysis
- Mean age of patients was 59 years (range: 24-90) and 45 out of 75 (60%) patients were male
- 6 out of 75 (8%) had Cdif colonization
- 54 out of 75 (72%) patients had at least one MDRO
  - ❖ 18 out of 75 (24%) patients had CRE rectal colonization (Table 3)
    - ~ 11 out of 18 (61%) of CRE positive patients were also co-colonized with another MDRO
  - ❖ 17 out of 75 (23%) patients had ESBL
  - ❖ 13 out of 75 (17%) had MRSA
  - ❖ 31 out of 75 (41%) had VRE

Conclusion

- There is a high rate of MDRO carriage (72%) in LTACH facilities
- A few useful steps to minimize or limit the spread of these pathogens include enhanced infection control measures, active surveillance of patients and good facility maintenance
- Comprehensive MDRO surveillance among LTACH patients is required periodically to limit spread of significant MDROs

Table 1. HardyCHROM™ ESBL chart for reading the plates.

INTERPRETATION OF RESULTS

24 hour Incubation	Interpretation /Recommended Action	Photo	Color
Pink to magenta colonies	Presumptive positive for 3rd generation cephalosporin non-susceptible *Enterobacteriaceae*. Subculture required for identification and antimicrobial susceptibility testing. Presumptive positive for ESBL-producing *E. coli*. Subculture required for identification and confirmation of ESBL phenotype.		
Blue to purple colonies with or without pink halo	Presumptive positive for 3rd generation cephalosporin non-susceptible *Enterobacteriaceae*. Subculture required for identification and antimicrobial susceptibility testing. Presumptive positive for ESBL-producing *K. pneumoniae* or *K. oxytoca*. Subculture required for identification and confirmation of ESBL phenotype.		
Yellow/Gold colonies with golden-orange halo in the surrounding medium	Presumptive positive for 3rd generation cephalosporin non-susceptible *Enterobacteriaceae*. Subculture required for identification and antimicrobial susceptibility testing.		
Colonies that are not pink to magenta, blue, blue with pink halos, or yellow/gold*	Negative – No ESBL-producing or 3rd generation cephalosporin non-susceptible *Enterobacteriaceae* detected.		

* Colonies that are colorless, white, off-white, yellow or green should not be considered as ESBL-producing or 3rd generation cephalosporin non-susceptible *Enterobacteriaceae*.

Table 2. List of antibiotic-containing disks used for susceptibility testing

Aztreonam	Amikacin
Ceftazidime	Ertapenem
Ceftriaxone	Meropenem
Cefotaxime	Cefoxitin
Cefepime	Tobramycin
Cefotaxime-clavulanate	
Ceftazidime-clavulanate	

Table 3. CRE culture and PCR Results

Testing Methods	Number of Positives	
CRE Culture	18	15 *K.pneumoniae*
		1 *K.pneumoniae* and *E.aerogenes*
		1 *E. cloacae*
		1 *M. morganii*
Xpert Carba -R	17	16 bla$_{KPC}$
		1 bla$_{KPC,NDM,VIM}$
In house bla$_{KPC}$/bla$_{NDM}$ PCR	16	16 bla$_{KPC}$

References

1. Munoz-Price LS. Long-term Acute Care Hospitals. Clin Infectious Diseases 2009;49:438-43
2. Munoz-Price LS, Magiera K, Brizek B, Stemer A, Weinstein RA. Characterization of central vascular catheter (CVC) related bloodstream infections (BSIs) at a long term acute care hospital (LTACH) [abstract K-3416] In: Program and abstracts of the 48th Interscience Conference
3. Mangold KA, Voss BA, Singh K, Thomson RB, Jr., Schora DM, Peterson LR, Kaul KL. Multiple broad-spectrum β-lactamase targets for comprehensive surveillance. J Clin Microbiol. Oct 2013;51(10):3423-3425