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

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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 the effect of enhanced infection control measures on this colonization. We conducted a point prevalence study of CRE’s, Extended spectrum β-lactamase producing Enterobacteriaceae (ESBLs), Vancomycin resistant Enterococci (VRE), Methicillin resistant Staphylococcus aureus (MRSA) and Clostridium difficile (C. difficile) carriage among patients at the LSHC 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 for CRE, ESBL, VRE and C. difficile.
• One double-headed Copan Transystem® with Liquid Stuart (Copan Diagnostics INC) and FecalSwab (Copan Diagnostics INC) was used to collect the anterior nasal swabs. Six anterior nasal swabs were collected for VRE, MRSA and C. difficile carriage.

PCR Testing:
• Cepheid Xpert® C. difficile/Epi (Cepheid Cdf): 400L of sample from FecalSwab transport tube was transferred into the elution reagent tube and vortexed at high speed for 10 seconds.
• The elution reagent tube was then transferred to the sample chamber in the GeneXpert® cartridge
• Real-time PCR was performed using GeneXpert® Ds instrument (Cepheid, Sunnyvale, CA) in accordance with the Cepheid Xpert® C. difficile/Epi assay’s package insert
• Cepheid Xpert® Carba-R (Cepheid Carba-R): Another 400L of sample from FecalSwab transport tube was transferred into the elution reagent tube and vortexed at high speed for 10 seconds.
• The elution reagent tube was then transferred to the sample chamber in the Cepheid Carba-R iCycler cartridge
• Real-time PCR was performed using GeneXpert® Ds instrument (Cepheid, Sunnyvale, CA) in accordance with the Cepheid Xpert® Carba-R assay’s package insert

In house PCR for blaKPC and blaNDM
• Real-time PCR detection of blaKPC and blaNDM was performed using a modification of a previously published method.
• One of the double-headed rectal swabs (Copan Transystem) was broken off into 1ml of Trizyme Soy Broth with 30g celite/millin disk and incubated overnight at 35°C
• After incubation, 50L of the overnight incubated enrichment broth was added to 200L of lys 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 and probe parameters to amplify blaKPC and blaNDM, as well as a 16S internal control, were combined into a single amplification reaction as previously described.

Culture Testing

MDRO Culture:
• A 10µl of sample from FecalSwab transport tube was plated directly onto HardyCHROMMap™ ESBL (Hardy Diagnostic, Santa Maria, CA) agar
• Plates were incubated at 33-35°C for 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 colonies were performed using MALDI-TOF (BD Biodiversity) 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 Ceftriaxone-clavulanate disks and Cefazidime/Clavulante 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 (CNA) with vancomycin disks
• Plates were incubated at 33-35°C for up to 24 hours
• Presence of mauve colonies were considered positive for MRSA

VRE Culture:
• One of the double-headed rectal swabs (Copan Transystem) was plated directly onto Columbia Nadalactic (CNA) agar with vancomycin disks
• Plates were incubated at 33-35°C for 18-24 hours
• Colonies 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
• 61 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%) were male
• 11 out of 18 (61%) of CRE positive patients were also colonized with another MDRO
• 17 out of 75 (23%) had ESBL cultured, as well as a 16S internal control was combined into a single amplification reaction as previously described.

• 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, 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.

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

Table 3. CRE culture and PCR Results

References