



INTERNATIONAL
SOCIETY
FOR INFECTIOUS
DISEASES

GUIDE TO INFECTION CONTROL IN THE HOSPITAL

CHAPTER NUMBER 50:

Other Enterobacteriaceae

Author

Kalisvar Marimuthu, MD

Chapter Editor

Michelle Doll, MD, MPH

Topic Outline

Topic outline - Key Issues

Known Facts

Controversial Issues

Suggested Practice

Suggested Practice in Under-Resourced Settings

Summary

References

Chapter last updated: April, 2018

KEY ISSUE

- CPEs remain largely nosocomial although community prevalence have been documented.
- In an endemic situation, ESBL colonization or infection among hospitalised patients results primarily from the patients' preexisting indigenous flora.
- Hospital transmission of MDREs frequently involves the hands of healthcare workers or contaminated inanimate surfaces.
- Outbreaks of MDRE have been linked to understaffing, overcrowding and poor hygiene practices in the hospital.
- Risk factors for acquiring MDRE varies between endemic and outbreak setting. Reported risk factors include severity of illness, mechanical ventilation, antibiotic pressure and presence of indwelling devices.
- CPE acquisition outside of healthcare institutions has been linked to food products, travel to high risk areas and medical tourism.
- Patients with CRE bacteremia have mortality as high as 50%
- Alcohol-based hand rubs are the most efficacious agents for reducing the number of Enterobacteriaceae on the hands of healthcare providers.

CONTROVERSIAL ISSUES

- Risk factors associated with prolonged CRE carriage is not clearly known but may vary in different groups of patients.
- Criteria that can be used to declare a patient cleared of CRE is unknown. These criteria may vary depending on epidemiology.
- The impact of antibiotic restriction on the emergence and spread of multiresistant Enterobacteriaceae in the hospital is under investigation. Several studies examined the effect of restricted use of

antibiotics particularly third-generation cephalosporins and carbapenems on the prevalence of resistant Enterobacteriaceae offering conflicting results.

- Cost effectiveness of various laboratory methods used to detect CPE is unknown.
- Evidence supporting environmental cleaning for control of CRE are limited to observational studies in outbreak settings. Regardless, most experts consider this as a vital step in CRE control.

SUGGESTED PRACTICE

Prevention of Transmission

- Strict hand hygiene compliance
- Surveillance for CRE carriers, if possible genotyping to identify specific carbapenemases
 - Surveillance cultures for early identification and isolation of CRE carriers should be conducted.
 - Risk stratification should be done at institution-level to identify population needing surveillance. Some groups of patients to be considered for surveillance include contacts of CRE colonized/infected patients and patients with history of recent hospitalization in an endemic setting.
 - Surveillance cultures can be done with rectal swabs or stool samples.
 - Regular monitoring for CRE from clinical cultures should be undertaken.
- Physical separation of CRE carriers
 - Single room isolation is available; or
 - Cohorting of CRE carriers with dedicated nursing, especially in an outbreak situation
- Contact precautions for CRE carriers

- Should include: ensuring appropriate patient placement, usage of personal protective equipment including gloves and gown, and use of disposable or dedicated patient-care equipment.
- Pre-emptive contact precaution can be considered for high risk patients
- Environmental cleaning
 - Cleaning of the patient zone is important to prevent transmission of CRE.
 - For single rooms, the entire room should be terminally cleaned after discharging a CRE carrier before admitting another patient.
 - Cleaning staff should be adequately trained.
 - Surveillance cultures of the environment may be considered especially in outbreak setting.
- Antibiotic stewardship program to reduce unnecessary antibiotic utilization
- Monitoring, audit and feedback

SUGGESTED PRACTICE IN UNDER-RESOURCED SETTINGS

- Adequate staffing to ensure adequate staff-to-patient ratio as poor staffing is associated with transmission of MDRE
- Ensuring availability of alcohol-based hand rubs
- Ensuring availability of microbiology laboratory to be able to identify CREs
- Monitoring of CREs from clinical cultures should be conducted and trend should be monitored to identify outbreaks
- In settings where single rooms are not available, strict adherence to contact precautions are vital. Within ward cohorting of CRE carriers may be considered e.g. placing CRE patients at the end of the ward

SUMMARY

The predominant genera of Enterobacteriaceae are *Escherichia*, *Klebsiella*, *Enterobacter*, *Citrobacter*, *Proteus*, *Serratia*, *Salmonella* and *Shigella*. Enteric pathogens are not discussed in this chapter. Incidence of CRE is increasing worldwide. Screening of high risk patients to identify CRE carriers early and physical separation while in the hospital are important CRE control strategies. Modification and adaptation of international guidelines are necessary to control CREs in resource limited settings.

REFERENCES

1. World Health Organization. "Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities." (2017).
2. Centers for Disease Control and Prevention. "CRE toolkit—guidance for control of carbapenem-resistant Enterobacteriaceae (CRE)." *Atlanta, GA: CDC* (2012).
3. Munoz-Price, L. Silvia, Laurent Poirel, Robert A. Bonomo, Mitchell J. Schwaber, George L. Daikos, Martin Cormican, Giuseppe Cornaglia et al. "Clinical epidemiology of the global expansion of *Klebsiella pneumoniae* carbapenemases." *The Lancet infectious diseases* 13, no. 9 (2013): 785-796.

4. Tacconelli, E., M. A. Cataldo, S. J. Dancer, G. Angelis, M. Falcone, U. Frank, G. Kahlmeter et al. "ESCMID guidelines for the management of the infection control measures to reduce transmission of multidrug-resistant Gram-negative bacteria in hospitalized patients." *Clinical Microbiology and Infection* 20, no. s1 (2014): 1-55.
5. Storr, Julie, Anthony Twyman, Walter Zingg, Nizam Damani, Claire Kilpatrick, Jacqui Reilly, Lesley Price et al. "Core components for effective infection prevention and control programmes: new WHO evidence-based recommendations." *Antimicrobial Resistance & Infection Control* 6, no. 1 (2017): 6.
6. Clinical and Laboratory Standards Institute (CLSI). Performance Standards for Antimicrobial Susceptibility Testing. Twenty Second Informational Supplement (January 2012), CLSI document M 100-S22. Wayne, Pennsylvania, 2012.
7. Harbarth S, Sudre P, Dharan S, et al. Outbreak of *Enterobacter cloacae* Related to Understaffing, Overcrowding, and Poor Hygiene Practices. *Infect Control Hosp Epidemiol* 1999; 20:598–603.
8. Ben-David D, Maor Y, Keller N, et al. Potential role of active surveillance in the control of a hospital-wide outbreak of carbapenem-resistant *Klebsiella pneumoniae* infection. *Infect Control Hosp Epidemiol* 2010 ;31 :620-626
9. Marchaim D, Chopra T, Bhargava A, et al. Recent exposure to antimicrobials and carbapenem-resistant Enterobacteriaceae : the role of antimicrobial stewardship. *Infect Control Hosp Epidemiol* 2012;33:817-830

10. Tschudin-Sutter S, Frei R, Dangel M, et al. rate of transmission of extended-spectrum beta-lactamase-producing Enterobacteriaceae without contact isolation. *Clin Infect Dis* 2012;55:1505-1511.