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# Molecular Characteristics of Carbapenemase-Producing Gram-Negative Pathogens Causing SSIs



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## Background

- Surgical site infection (SSI) is a commonly-occurring healthcare-associated infection.
- Increased morbidity and mortality are associated with SSI, ranging from wound discharge associated with superficial skin infection up to life-threatening conditions such as severe sepsis.<sup>1</sup>

## Materials and Methods

- A prospective incidence- based surveillance study was conducted on 489 patients with operation history and admitted to Intensive Care Unit (ICU) of New Emergency Hospital, one of Cairo University hospitals (CUHs), over one year starting from September 2014. Patients who had operation history were followed in collaboration with the hospital Infection Control Team. Clinical data was collected from these patients by means of specifically designed forms. The data was analyzed according to the specific case definitions provided by the Centers for Disease Control and Prevention (CDC, 2014).<sup>2</sup>

### References:

1. Korol E.; Johnston K.; Waser N.; Sifakis F. and Jafri H. S. *et al.*, (2013): A Systematic Review of Risk Factors Associated with Surgical Site Infections among Surgical Patients. *PLoS ONE*. 8(12): e83743.
2. Centers for Disease Control and Prevention CDC/NHSN surveillance (2014): Definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Available from: <http://www.cdc.gov/nhsn>.
3. Clinical and Laboratory Standards Institute (CLSI) (2015): Performance standards for antimicrobial susceptibility testing: 25th informational supplement. Wayne, PA, USA, M100-S25.
4. Poirel L.; Walsh T. R.; Cuvillier V. and Nordmann P. (2011): Multiplex PCR for detection of acquired carbapenemase genes. *Diagn Microbiol Infect Dis*. 70: 119-125..

- Proper wound specimens from patients with suspected surgical site infections were collected as ordered by the physician in charge, submitted to the hospital microbiology laboratory to provide identification of pathogens by conventional method and MALDI-TOF for non-lactose ferment Gram-negative pathogens. Antimicrobial susceptibility of all isolates was determined by the standard *Kirby Bauer* disc diffusion method and E-test (CLSI, 2015).<sup>3</sup>
- All Gram-negative pathogens (GNP) caused SSIs and showed reduced susceptibility to carbapenem were screened for carbapenemase production by Carba NP test and multiplex conventional PCR.
- DNA was extracted from all carbapenem resistant Gram-negative isolates by boiling method and screened for presence of eleven carbapenemase genes. Through, three multiplex reactions were defined for detection of blaIMP, blaVIM, blaSPM, blaOXA-48, blaNDM, blaKPC, blaBIC, blaAIM, blaGIM, blaSIM, and blaDIM.<sup>4</sup>

## Results

- During surveillance duration (6.7%) of ICU patients who had operation developed SSI; abdominal surgeries represent (60.6%) of these SSIs, while neurosurgeries and orthopedic-surgeries represent (18.2% and 15.2% respectively).
- Overall, (84.8%) of the SSIs caused by GNP. The most prevalent causative organisms for SSIs were *Paeruginosa* (30.3%) followed by *A.baumannii* and *K.pneumoniae* (18.2% for each ).

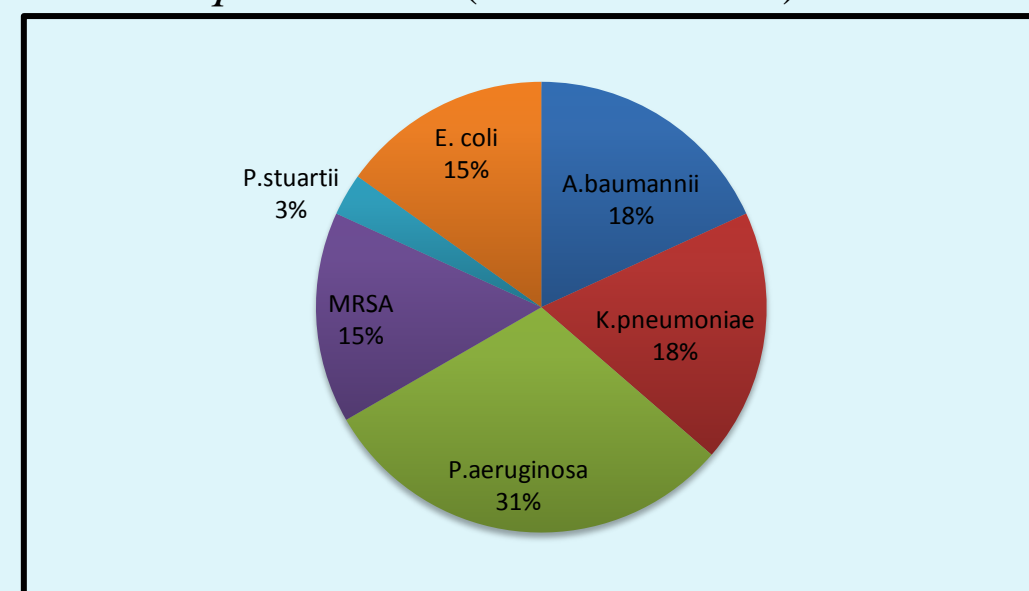


Figure: Distribution of SSI Pathogens in ICU Patients.

- Carbapenem resistance among GNP caused SSIs (53.6%) and (7.1%) showed intermediate resistance to carbapenem. (58.8%) of carbapenem resistant Gram-negative pathogens (CR-GNP) showed carbapenemase production.

- blaVIM was the most prevalent gene encoded for carbapenemase production.
- No carbapenemase gene were detected in (41.2%) of CR-GNP. One *K.pneumoniae* isolate showed two genes of carbapenemase production blaKPC and blaNDM.

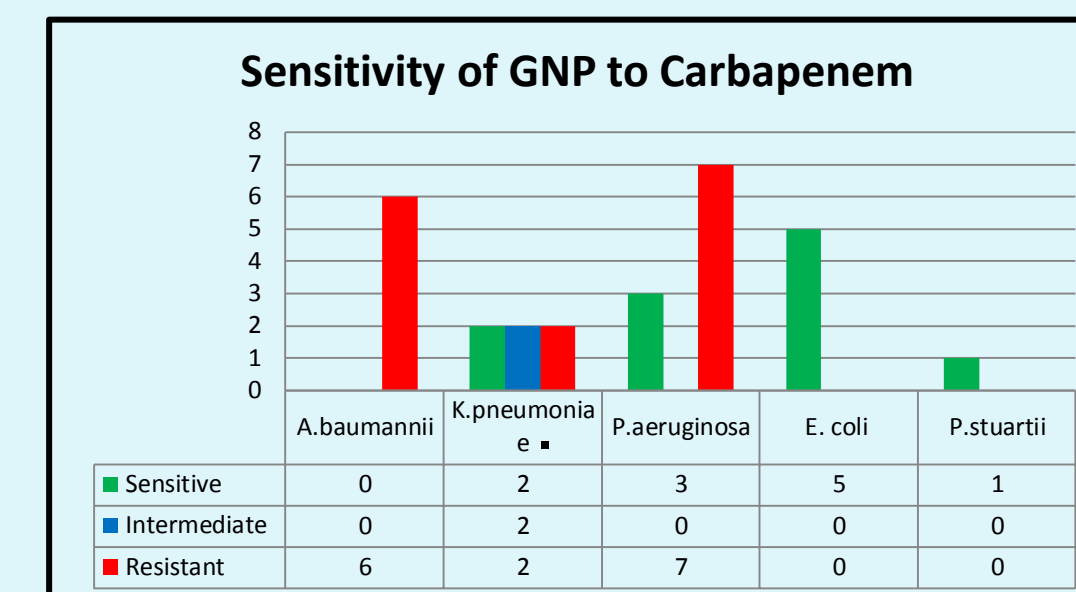


Figure : Sensitivity of Gram- Negative Pathogens Caused SSIs to Carbapenem.

## Conclusions

- Gram-negative pathogens were the commonest causes of SSIs among ICU patients.
- Carbapenem resistance among the Gram-negative pathogens was very high, representing a significant clinical and public health concern.
- Our results suggested that we should pay more attention for rapid method to detect carbapenemase GNP as Carba NP test; to help in strict implementation of infection control measures and avoid the rapid spread or of carbapenemase-producing GNP.