Impact of Carbapenem-Resistant Pathogens on Mortality among Hospitalized Adult Patients

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ABSTRACT

Background: The prevalence of carbapenem-resistant (CR) Gram-negative bacteria has become a significant problem. We investigated the impact of CR A. baumannii, Pseudomonas aeruginosa, Klebsiella pneumoniae, and Escherichia coli infections on mortality among hospitalized adults.

Methods: Hospitalized patients with laboratory confirmation of infection with each of four pathogens were identified using Premier Hospital Laboratory Database records and were categorized into Carbapenem Susceptible (CS) and Carbapenem Resistant (CR) groups. Patients were excluded if site data were incomplete or unavailable. Cox proportional hazards models were used to estimate adjusted mortality rates with 95% confidence intervals (CIs) using the comorbidity index (Table 2). Data from all sites were entered into the Premier Healthcare Database and two cohorts (CR and CS) were identified based on antibiotic susceptibility data. The primary outcome measured was in-hospital mortality (Crude). The difference in mortality between CR and CS pathogens was estimated for each of these pathogens.

RESULTS

CR was most common in A. baumannii infections, and followed by CR P. aeruginosa and CR Klebsiella pneumoniae. Mortality was higher in CR compared to CS infections for patients with most CR pathogens/sites than for most CS. CR was most common in A. baumannii infections. In-hospital mortality (Crude) was greater for patients with most CR pathogens/sites than for most CS. Patients with CR A. baumannii tended to be slightly older and had a higher mean Charlson comorbidity index score than patients with CS A. baumannii. Patients with CR infections were more likely to have elevation of any site.

CONCLUSIONS

The prevalence of CR A. baumannii in all infection sites. The crude mortality rates were higher for CR vs CS infections, for most pathogen or infection site.

INTRODUCTION

Infections due to carbapenem-resistant (CR) Gram-negative bacteria are an increasing global problem. In some regions, substantial percentages of hospitalized patients are colonized or infected by these microorganisms, which have caused severe outbreaks of severe infections on health care facilities. There is a lack of systematic epidemiologic studies from US hospitals, describing the frequency, and the clinical impact of the infections of CR Gram-negative bacteria.

Several studies have reported the influence of the CR Gram-negative bacteria on the mortality among hospitalized patients. A. baumannii, P. aeruginosa, and K. pneumoniae were associated with increased mortality. The number of deaths with CR was twice as much as with CS strains. However, there is a scarcity of studies which investigated the effect of more than two strains in the same database. The objectives of our study were to investigate the impact of the CR Gram-negative bacteria on the mortality and to determine the risk factors of the mortality by each infection site (blood, respiratory, urinary, Other).

MATERIALS AND METHODS

Study Design and Population

Data Source: Premier Research Database is the largest repository of detailed acute care hospital patient data in the USA. Premier Hospital Laboratory Database includes data from a large number of hospitals, and the laboratory test data are obtained from telephone interviews with lab managers. The Premier Hospital Laboratory Database was used to identify eligible patients with a positive result.

Methods: All available laboratory results from 2009 to 2013 were evaluated. Any specimen with a positive result for A. baumannii, P. aeruginosa, Klebsiella pneumoniae, or E. coli was identified. The patients were identified and categorized as either Blood, Respiratory, Urinary, or Other. For discharges where there were multiple positive specimens from the same site, the specimen with the earliest date was selected.

3. The sample was then restricted to include only specimens where laboratory sensitivity data was available.

4. Each specimen was evaluated to determine if the sample was resistant to imipenem, doripenem, ertapenem, or meropenem. If the susceptibility test indicated the specimen was resistant to any of these four antibiotics, it was classified as CR. If the susceptibility test was sensitive to any of these four antibiotics, it was classified as CS.

5. After identifying eligible laboratory observations, this data was linked to the hospital data file and patient record via person identification number, age, gender, and patient comorbidities as well as other patient-level variables.

Statistical Analysis

Categorical data were analyzed using a 2 x 2 Fisher’s exact test where appropriate. Continuous variables were analyzed using the Kruskal-Wallis test. Mortality rates for each of the pathogen or infection site were calculated. The in-hospital mortality was calculated using the comorbidity index (Table 2). Data from each hospital were entered into the Premier Healthcare Database and two cohorts (CR and CS) were identified based on antibiotic susceptibility data. The primary outcome measured was in-hospital mortality (Crude). The difference in mortality between CR and CS pathogens was estimated for each of these pathogens.

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