Predicting carbapenem resistance among gram-negative pathogens in complicated urinary tract infections

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ABSTRACT
Introduction: Rising antibiotic resistance increases the risk of exposure to inappropriate empiric treatment. Carbapenem resistance (CR) is a concern in complicated urinary tract infections (cUTI). To facilitate improved antibiotic stewardship for cUTI, we developed a bedside instrument to predict CR.

Methods: We developed a predictive model using a 4×20 cohort approach within the Premier Research Database (2000–2010) of 370,000 hospitals. We included all hospitalized patients with at least one positive urine culture, all CR organisms, and were treated with an antibiotic starting on the day of the index culture and continued for 14 days or more. We defined an assemblage of CR by 1 or more susceptibility categories to imipenem, meropenem, or doripenem.

Results: Among 252,965 patients with CR (1.7%, 95% CI 1.5%–2.0%), CR was more common among patients with a higher comorbidity burden than CS (median [IQR] Charlson Comorbidity Index 3 [2, 4] vs. 2 [1, 3], p<0.001). Women were more likely to have CR than men (51.8% vs. 43.8%, p<0.001), and more than 50% of CR patients were categorized as having extended care facility or mechanical ventilation. CR was more likely to have a higher prevalence of prior antibiotics treatment (49.0% vs. 41.0%, p<0.001) or prior CR (10.5% vs. 1.3%, p<0.001). Overuse of broad-spectrum antibiotics associated with worsened outcomes (odds ratio 2.40, 95% CI 2.13–2.72, p<0.001) and increased CR (6.5% vs. 3.5%, p<0.001). If no CR organism, then first culture growing out one of the organisms predefined as a CR organism (11.8% vs. 0.9%, p<0.001). In a model assigning weighted points for: admission from an ECF (1), history of weight loss (1), early mechanical ventilation (1), age<50 (2), male gender (3), prior antibiotics treatment (4), prior CR (5), the model exhibited good discrimination (c-statistic 0.721), performing better among hospitals with low rates of CR.

CONCLUSIONS: A simple bedside score was able to identify cUTI patients at low risk for CR. To develop and validate a predictive score to be used at the bedside to identify hospitalized patients with CR, we performed a retrospective study of patients with cUTI in the US (n=252,965). Using our score may help reduce overuse of broad-spectrum antibiotics associated with worsened outcomes and prolonged hospitalization. Our simple bedside score was able to identify cUTI patients at low risk for CR.