Vancomycin vs. Vancomycin/Piperacillin/Tazobactam Associated Acute Kidney Injury in Non-Critically Ill Patients

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Introduction

There is a growing need to employ broad spectrum antibiotics due to the rise of multi-drug resistant organisms. Many patients admitted to Tripler Army Medical Center (TAMC) receive an anti-pseudomonal beta-lactam in addition to vancomycin. Vancomycin is known to cause an increased risk of acute kidney injury (AKI) and the use of vancomycin with piperacillin/tazobactam has been implicated in an increased rate of kidney injury. This analysis characterizes the rate of AKI in these two regimens within TAMC and to contrasts baseline patient characteristics to account for confounding factors.

Methods

Retrospective Quality Improvement Analysis conducted at a 450 bed federal tertiary care center. Data collection between May 2012 and October 2014.

Inclusion Criteria:
- Patients aged 17 years and older
- Admitted to medical/surgical ward
- Received vancomycin or combination vancomycin and piperacillin/tazobactam for at least 48 hours

Exclusion Criteria: see Figure 1

AKI defined by the Acute Kidney Injury Network (AKIN) definition as an abrupt (within 48 hours) increase in serum creatinine (SCr) of ≥0.3 mg/dl, ≥0.5 mg/dl, or ≥25% from baseline. Chi-square, Fisher’s exact, and nonparametric Wilcoxon rank sum tests were used to compare demographic and baseline characteristics. Multivariate logistic regression models were used to assess if incidence of AKI was associated with treatment adjusted for propensity score (based on predicting therapy from indication) and potential risk factors. A significance level of 0.05 was used for all analyses.

Results

1133 patients were evaluated retrospectively to determine the incidence of AKI and 678 patients were excluded. 49 of the 202 (24%) patients taking vancomycin and piperacillin/tazobactam developed AKI in contrast to 28 of the 253 patients (11%) given vancomycin, odds ratio 2.50 (95% CI 1.49-4.2, p<.001). Dual therapy remains significant after adjusting for age, sex, BMI, propensity score, contrast administration, and pre-existing comorbid status as evaluated by CCI, though both contrast administration (p<.001) and CCI >6 (p=0.028) were found to be an independent risk factor for AKI.

Discussion/Conclusions

Significant increase in the rate of nephrotoxicity was noted in combination vancomycin and piperacillin/tazobactam as compared to vancomycin. This result was found to be irrespective of clinical characteristics to include age, sex, and medical comorbidities. Given the high morbidity and mortality which accompanies acute kidney injury, further studies should be undertaken to establish this trend in a prospective manner and to evaluate the rate of nephrotoxicity in other empirical regimens with comparable coverage to vancomycin and piperacillin/tazobactam. Furthermore, these findings reinforce the need to employ broad spectrum empiric therapies when possible.

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Table 1. Patient demographics/baseline characteristics: peak SCr and Charlson Comorbidity Index (CCI) were statistically significant.

Table 2. Administration of concomitant nephrotoxic factors by percent. Statistical significance was shown with a p-value of less than or equal to 0.05 (p<.001).

Figure 1. Patient selection and exclusion flowchart. SCr, serum creatinine; AKI, acute kidney injury.

Figure 2. Treatment Indication and associated AKI: Vancomycin was statistically associated with meningitis, UTI, and neutropenic fever. Vancomycin/piperacillin/tazobactam was statistically associated with joint infection/staphylococcal as treatment indication.

Figure 3. Administration of concomitant nephrotoxic factors by percent. Statistical significance was shown with a p-value of less than or equal to 0.05 (p<.001).

Figure 4. Graphical comparison of rate of AKI in vancomycin (11%) as compared to vancomycin/piperacillin/tazobactam (24%).

The authors would like to thank Michael Lushik, clinical statistician, for his aid in statistical analysis of the data.