

Vancomycin-Related Renal Insufficiency: Does Race Play a Role?

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Introduction

- African Americans have a two to four time's higher lifetime risk of acute kidney injury (AKI) and chronic kidney disease than Whites.
- Vancomycin has a potential for nephrotoxicity.
- The objective of this study was to determine if the incidence of renal insufficiency among patients being treated with vancomycin differed by race.

Methods

Patients

- Retrospective study of adult (≥ 18 y) inpatients on vancomycin for ≥ 48 hours between January 2012 and December 2014
- Data on demographics (age, gender, and race), co-morbid conditions, clinical characteristics, vancomycin dose, duration, indication and nephrotoxic drugs were collected
- Patients with a CrCl <30 ml/min or undergoing dialysis were excluded
- Acute kidney injury (AKI) was defined as an increase in serum creatinine by 0.3 mg/dL or ≥ 1.5 times the baseline value
- Optimal vancomycin trough levels were defined (10- 20 mg/L) per established guidelines

Statistical methods

- Data were analyzed using the chi squared test, Student's t-test, analysis of variance, the Mann-Whitney U test and logistic regression with SPSS v. 24.0
- A p value <0.05 was considered to indicate statistical significance
- The study was approved by the SJH&MC Institutional Review Board

Results

- 1,130 patients were identified during the study period.
- Table 1 shows patient characteristics and vancomycin pharmacokinetic parameters by race.
- Whites were older, more likely to be on nephrotoxic drugs ($p=0.025$) and had a higher prevalence of malignancy ($p < 0.0001$).
- Blacks were more likely to have a history of renal disease ($p=0.03$), diabetes ($p=0.001$), and HIV ($p < 0.0001$).
- There was no difference in the indications for vancomycin use by race.
- AKI was seen in 8.3 % (93) of patients (Table 2 & Table 3)

Table 1. Patient Characteristics and Vancomycin Trough Levels by Race

Characteristics	White (n=586)	Black (n=544)	p-value
Age years; mean \pm SD	56.7 \pm 14.6	48.3 \pm 14.6	<0.0001
Body mass index (kg/m ²)	29.8 \pm 8.3	29.7 \pm 9.7	0.81
Charlson weighted index of Comorbidity	1.48 \pm 1.9	1.50 \pm 2.0	0.80
Baseline serum creatinine (mg/dL)	0.80 \pm 0.30	0.86 \pm 0.30	<0.0001
Median (IQR) end of treatment serum creatinine (mg/dL)	0.71 (0.32)	0.78 (0.36)	<0.0001
Initial trough level (mg/L)	13.5 \pm 6.5	13.9 \pm 7.0	0.26
Maximum trough level (mg/L)	17.1 \pm 11.5	16.8 \pm 7.9	0.64
Duration of therapy days	5.1 \pm 3.7	4.9 \pm 2.8	0.33

Table 2. Univariate Analysis for Predicting Acute Kidney Injury

Characteristics	AKI (n=93)	No AKI (n=1037)	p-value
Race : Black White	55 (10.1%) 38 (6.5%)	489 (89.9%) 548 (93.5%)	0.027
Charlson score (mean \pm SD)	2.25 \pm 2.44	1.42 \pm 1.9	0.002
Body mass index (kg/m ²)	32.41 \pm 11.31	29.54 \pm 8.77	0.019
Soft tissue Bone and joint Sepsis / SIRS Pneumonia Gastrointestinal /Genitourinary Others	25 (4.5%) 3 (7.1%) 42 (12.9%) 14 (10.9%) 5 (16.1%) 4 (7.5%)	525 (95.5%) 39 (92.9%) 283 (87.1%) 115 (89.1%) 26 (83.9%) 49 (92.5%)	<0.0001
Initial trough level (mg/L)	18.97 \pm 8.56	13.24 \pm 6.32	<0.0001
Maximum trough level (mg/L)	26.17 \pm 10.67	16.13 \pm 9.4	<0.0001
Median (IQR) end of treatment serum creatinine (mg/dL)	1.44 (0.67)	0.71 (0.31)	<0.0001

Table 3. Multivariate Analysis for Predicting Acute Kidney injury

Independent Predictor	Odds Ratio	p-value	95% Confidence Interval
Black race	1.779	0.021	1.091, 2.902
Body mass index	1.035	0.003	1.012, 1.059
Charlson weighted index of comorbidity	1.147	0.005	1.041 , 1.264
Sepsis /SIRS	3.179	<0.0001	1.831, 5.522
Pneumonia	3.267	0.002	1.549, 6.890
Gastrointestinal / Genitourinary	3.457	0.028	1.145, 10.436
High vancomycin trough level	5.722	<0.0001	3.507, 9.335

Conclusions

- A higher incidence of acute kidney injury was seen in Blacks.
- Whites were older, more likely to be on nephrotoxic drugs and had a higher prevalence of malignancy.
- Blacks were more likely to have renal disease, HIV and diabetes.
- Sepsis/ SIRS, pneumonia and gastrointestinal/genitourinary as indication for vancomycin were associated with AKI.
- Black race, higher vancomycin trough level, higher BMI and higher Charlson score were independently associated with AKI.
- Different racial nomograms for vancomycin trough levels need to be considered.

Limitations

- Single center study
- Retrospective chart review
- Additional studies are needed to determine if our observations are unique to our patients, or represent a national trend