Evaluation of Nephrotoxicity Associated with Vancomycin and Recovery Rates of Acute Kidney Injury Over a Five-Year Period

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OBJECTIVE

To evaluate the frequency, reversibility, and factors influencing vancomycin-associated nephrotoxicity (VAN) in oncology patients at SKMCH&RC over a five-year period.

Specifically, the study aimed to:

- Determine the incidence of nephrotoxicity among patients receiving vancomycin, expressed as cases per 1,000 patients and per 100 patient-days.
- Assess the proportion of acute kidney injury (AKI) events that were reversible versus irreversible.
- Explore associations between vancomycin exposure variables (age, duration, serum levels) and the reversibility of nephrotoxicity.

METHODS

A five-year retrospective cohort study was conducted using ADR reports from July 2019–June 2024.

Patients who developed vancomycin-associated AKI were identified using HIS data.

Inclusion: oncology patients with vancomycin exposure ≥48 h.

Exclusion: Pre-existing CKD, concomitant nephrotoxic drugs without clear attribution.

Data analysis:

- *Orange* data-mining tool and *Excel*
- Student's t-test
- Chi-square test ($p<0.05$).

Inferential analysis was performed using chi-square or Fisher's exact test for categorical variables and independent-samples t-test or Mann–Whitney U test for continuous variables, with statistical significance set at $p < .05$.

Results

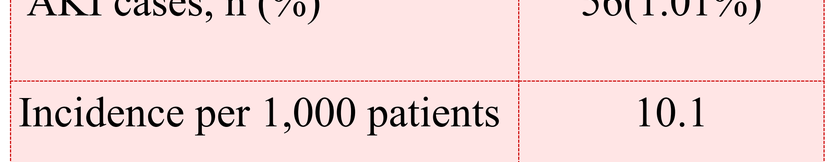
TABLE 1. Characteristics of reversible vs. irreversible AKI cases

Variable	*Reversible(n=47)*	*Irreversible(n=9)*	*p-value*
Age, years (mean ± SD)	34.3	42.9	ns
Male, n (%)	23(49%)	6 (67%)	0.541
Duration of therapy, days (mean)	8.1	6.7	ns
Vancomycin level at toxicity (µg/mL, mean)	37.1	42.2	0.257

TABLE 2. Incidence of vancomycin-associated nephrotoxicity

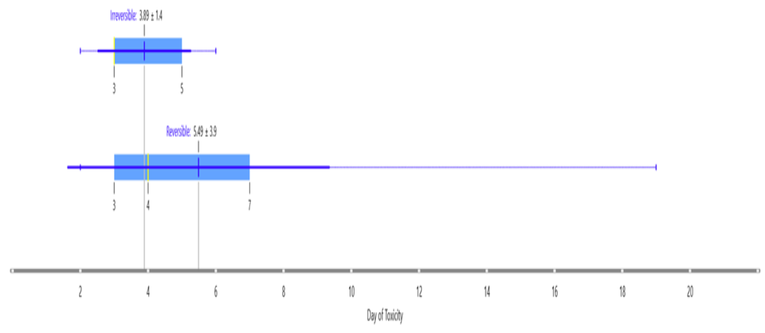
Metric	*Value*
Total patients on vancomycin	5,538
Total patient-days	21,023
AKI cases, n (%)	56(1.01%)
Incidence per 1,000 patients	10.1
Incidence per 1,00 patient-days	0.266
Reversible AKI, n (%)	47 (83.9%)
Irreversible AKI, n (%)	9 (16.1%)

Figure 1: Distribution of reversible vs. irreversible nephrotoxicity cases



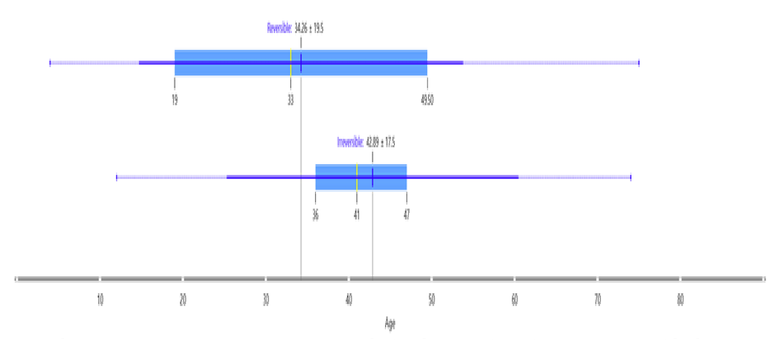
Out of the 56 nephrotoxicity cases identified, 47 (83.9%) were reversible while 9 (16.1%) were irreversible. The difference in distribution was highly significant ($\chi^2 = 48.83$, $p < 0.001$) (Figure 1). This indicates that the majority of vancomycin-associated AKI events were reversible, with only a minority progressing to irreversible renal damage

Figure 2 Day of Toxicity



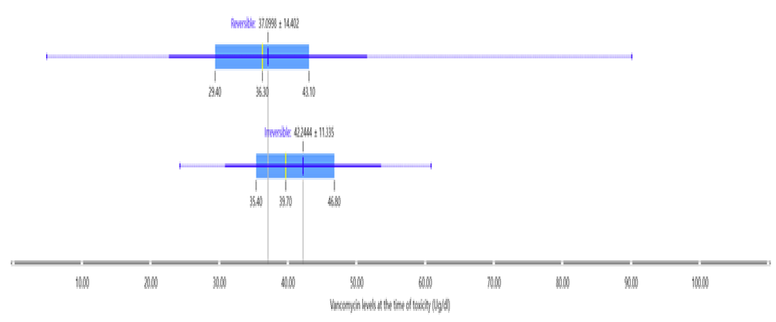
The onset of nephrotoxicity occurred significantly earlier in irreversible cases compared to reversible ones. The mean day of toxicity was 3.9 ± 1.4 days for irreversible cases versus 5.5 ± 3.9 days for reversible cases, and this difference was statistically significant ($p = 0.034$) (Figure 2). This finding suggests that earlier onset of AKI may be an indicator of irreversibility in vancomycin-associated nephrotoxicity.

Figure 3 patient age in reversible vs. irreversible nephrotoxicity



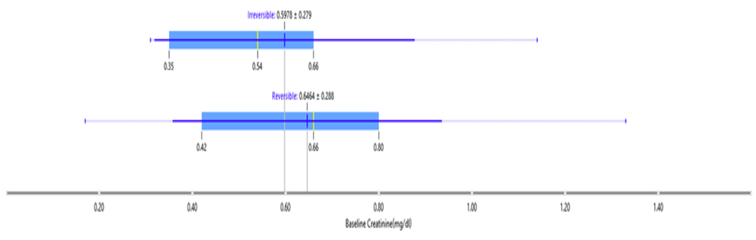
The mean age was higher in irreversible cases (42.9 ± 17.5 yrs) than reversible (34.3 ± 19.5 yrs), but not statistically significant ($p = 0.209$).

Figure 4 Vancomycin serum trough levels at the time of toxicity



Mean vancomycin levels were higher in irreversible cases (42.2 ± 11.3 µg/mL) than reversible (37.1 ± 14.4 µg/mL), but not statistically significant ($p = 0.257$).

Figure 5: Impact of baseline creatinine



Baseline renal function was similar in both groups.

CONCLUSION

- Vancomycin-associated nephrotoxicity is **uncommon (1.01%)** but clinically relevant.
- **83.9%** of AKI cases were reversible with discontinuation or hydration.
- **Early-onset AKI (<4 days)** was a potential marker of irreversible injury.
- Continuous renal monitoring and individualized dosing are essential for oncology patients receiving Vancomycin.