Incidence of Acute Kidney Injury in Oncology Patients Receiving Piperacillin/Tazobactam and Vancomycin
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Background
Acute kidney injury (AKI) occurs in approximately 5-20% of all hospitalized patients and is associated with an increase in morbidity and mortality. When evaluating this incidence in hospitalized patients, specifically oncology patients, the 1-year risk was found to be 17.5%. Cancer itself is a risk factor for developing an AKI, but additional risk factors for AKI in the oncology population include advanced age (>65 years old), congestive heart failure, chronic kidney disease, hypovolemia, distant metastases, multiple myeloma, liver cancer, nephrectomy for renal cell carcinoma, chemotherapy regimens for lymphoma, and induction chemotherapy for acute leukemia. Due to its broad-spectrum coverage of microbes, such as *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus* (MRSA), concomitant use of piperacillin/tazobactam and vancomycin as empiric antimicrobial therapy is common. Both vancomycin and piperacillin/tazobactam have independently been associated with rates of AKI ranging from 15-34%. Several of these studies have reported baseline characteristics of comorbid conditions, including types of cancer, but none have addressed the oncology population specifically. The purpose of this study is to evaluate the incidence of AKI with concomitant piperacillin/tazobactam and vancomycin in patients admitted to the medicine-oncology service.

Methods
This study was a retrospective medical record review of patients admitted to the medicine-oncology service from July 1, 2016 through June 30, 2018. Eligible patients were identified through a query in the Cerner information database for patients receiving piperacillin/tazobactam and vancomycin during the pre-specified date range. Patients were included if they were 18 years of age or older, have received piperacillin/tazobactam and vancomycin for at least 48 hours, and have a serum creatinine measurement within 24 hours of admission. Patients were excluded if they received dialysis on admission, have a history of a kidney transplant, are a prisoner, or are pregnant.

The primary outcome was the incidence of AKI defined by the Kidney Disease: Improving Global Outcomes (KDIGO) criteria. Secondary outcomes include time to onset of AKI, stage of AKI, duration of AKI, and resolution of AKI by discharge. Outcomes were analyzed using descriptive statistics, chi-squared or Fisher’s exact, student’s t-test, and odds ratios.

Results
A total of 270 patients were identified in Cerner with 138 patients meeting inclusion criteria. The incidence of AKI was 28%. The average time to onset of AKI was five days with the majority of patients having a stage 1 AKI (61%). The average duration of AKI was 6.58 days with 39% resolution at hospital discharge. Average age of patients who developed an AKI was 55 years old versus 60 years old in those who did not (p=0.03). In patients who developed an AKI, 87% had solid tumors and 13% had hematologic malignancies. Administration of intravenous contrast and loop diuretics, increased days of vancomycin therapy, and peak vancomycin trough >20 µg/mL were all independently associated with a significantly higher incidence of AKI.
Conclusion
The incidence of AKI in medicine-oncology patients receiving piperacillin-tazobactam and vancomycin for at least 48 hours was higher than the approximate 20% incidence rate reported from previously published studies in non-critically ill patients. Concomitant administration of nephrotoxic medications, especially IV contrast and loop diuretics should be used judiciously as both were found to increase the odds of patients developing an AKI. Though adults older than 65 with cancer are at an increased risk of developing AKIs, younger patients in this study were at increased risk.