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BRIEF REPORT

Counting the Cost of Daptomycin Versus Vancomycin in Hospitalized Patients: A Cost Minimization Analysis

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Daptomycin use for gram-positive infections has increased. This cost minimization analysis aimed to determine cost and/or time savings of daptomycin over vancomycin. The estimated hospital cost savings was US$166.41 per patient, and pharmacist time saved of almost 20 minutes per patient. Daptomycin has the potential to save both time and money.

Keywords. bacterial infection; cost analyses; daptomycin; gram-positive; vancomycin.

Vancomycin is the standard of care for treating serious infections caused by gram-positive organisms in hospitalized patients [1, 2]; however, challenges exist in optimizing vancomycin use, including appropriate dosing, monitoring, and adverse effects [3]. Additionally, dosing and monitoring of vancomycin constitutes a significant portion of time for primarily pharmacists to order and assess concentrations, make dosage adjustments, and compose pharmacokinetic notes in the electronic medical record [4]. Daptomycin, with once-daily dosing and no therapeutic drug monitoring, represents a comparable alternative in patients without respiratory tract or central nervous system infections. Daptomycin's use was previously limited by cost (average wholesale price [AWP]: US$535 per 500 mg) compared to vancomycin (AWP: US$7.70 per 1 g) [5], but not necessarily anymore, as a generic version of daptomycin was introduced to the market in 2016 (current AWP: US$47 per 500 mg) [6]. The purpose of this study was to determine whether daptomycin, at contemporary dosing strategies and current pricing, could represent a significant cost and/or time savings over vancomycin when treating hospitalized adult patients with infections caused by gram-positive organisms, assuming both agents would produce equivocal health outcomes.

METHODS

This multicenter, retrospective cost minimization study assessed all adult hospitalized patients who received at least 1 dose of intravenous vancomycin between 1 January 2017 and 31 July 2021 for inclusion. Contributing sites were asked to include at least 50 patients, randomly selected between the study dates. Patients who received vancomycin with an indication for treatment of a respiratory tract infection, a central nervous system infection, or surgical site infection prophylaxis were assessed as the "vancomycin group." All other indications for vancomycin were assessed as the "daptomycin-eligible group." The Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist was followed, and the perspective presented below is from that of the hospital, primarily within the pharmacy department as it relates to patient care activities [7]. All sites received institutional review board approval, and patient consent was not required, as this was a retrospective study.

All associated costs are in Table 1. Direct costs for vancomycin, daptomycin, normal saline intravenous bags, and 5% dextrose intravenous bags were determined using currently available average wholesale pricing per vial as available in the Redbook [8]. Estimated direct costs of vancomycin serum concentrations were determined by adding the current cost of phlebotomy supplies [9] with the current cost of trough measurement [10]. Direct costs of creatine kinase (CK) concentrations were determined by adding the current cost of phlebotomy supplies [9] with the current cost of CK measurement, with the assumption that CK measurements would be performed at baseline and weekly thereafter for the duration of therapy [11]. Drug preparation costs and drug administration costs were not calculated, as they were assumed to be equivalent for vancomycin and daptomycin.

Additional costs included the estimated time each pharmacist takes to review charts, perform calculations, interpret results, and follow up with patients (~8 minutes per patient for initiation or dose changes; ~3.5 minutes for assessments with no changes) [3], all divided by the median hourly wages for pharmacists [12] based on national averages reported by the US Bureau of Labor Statistics, respectively, not including benefits.

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Table 1. Associated Costs Used for Calculations

Variable	Monetary Values, 2024 US Dollars
Drug only	
Daptomycin, per gram	$94
Vancomycin, per gram	$7.70
Base solution only	
Normal saline, per mL	$0.11
5% dextrose, per mL	$0.07
Drug concentrations only	
Vancomycin, per collection	$190
Creatine phosphokinase, per collection	$28
Phlebotomy supplies, per collection	$54.43
Pharmacist oversight for vancomycin	
8 min for initiation or dose changes at $62.22 per hour	$8.30
3.5 min for assessment with no changes at $62.22 per hour	$3.63
Renal replacement therapy	
Hemodialysis, per day	$718.01
Continuous renal replacement therapy, per day	$1213.55
Hospital bed cost, per day	
General practice unit	$1501.75 (MS) $2404.91 (GA)
Intensive care unit	$11 354.91

Sources: [5, 8, 10-18].

Abbreviations: GA, Georgia; MS, Mississippi.

Development of acute kidney injury (AKI) attributable to vancomycin was defined as a change in serum creatinine by ≥0.3 mg/dL or ≥50% increase from baseline (whichever was greater) on ≥2 consecutive days within 5 days of initiating vancomycin therapy and up to 72 hours after the final dose in the absence of an alternative explanation [3]. Development of rhabdomyolysis attributable to daptomycin was defined as CK value >2000 U/L. The reported incidence of daptomycin-induced rhabdomyolysis in clinical trials was 2.8%; however, because management includes discontinuation of daptomycin or finishing treatment course pending duration remaining and side effects present, the predicted cost of this adverse event was not included in final calculations. Cost of AKI secondary to vancomycin was measured by summing the cost of bed type (intensive care unit [ICU] vs general practice unit) and need for renal replacement therapy (RRT; hemodialysis vs continuous RRT) [13–17]. Estimated daptomycin dosing was divided into categories (4, 6, 8, and 10 mg/kg actual body weight) based upon indication. When ranges of daptomycin were recommended per a tertiary drug reference [5], the higher mg/kg was utilized.

The primary outcome was the total estimated cost of treatment per patient. Secondary outcomes included the cost of treatment per infection (skin/wound, urinary tract, complicated intra-abdominal, etc) and hospital length of stay. All costs were currently reported values. All cost estimates from the literature were inflation adjusted to 2024 US dollars, as appropriate, using the US Bureau of Labor Statistics Consumer Price Index Inflation Calculator [18].

Data collected included hospital characteristics (eg, hospital size, type, location, days of therapy [DOTs] for vancomycin and daptomycin, and presence of an antimicrobial stewardship program) and patient characteristics (eg, age, sex, weight, and renal function). DOTs were used to quantify consumption, as all participating facilities had not yet adopted standardized antimicrobial administration ratio reporting during the study period. All aspects of vancomycin and daptomycin therapy were collected, along with relevant microbiological characteristics and clinical outcomes. The study endpoints were examined using descriptive statistics performed on SPSS software version 29.0 (IBM, Armonk, New York).

RESULTS

Four hospitals with active antimicrobial stewardship programs in the southeastern United States contributed patients to the study. Three of the 4 hospitals were community hospitals, and all hospitals were located in urban areas and ranged between 251 and 750 beds. Three of the 4 hospitals restrict daptomycin's prescribing to an infectious diseases provider/team, and 1 of the 4 switched vancomycin dosing and monitoring from trough-based to area under the curve (AUC)–based in 2020. The hospital that changed to AUC-based dosing utilized external software with single-concentration monitoring. The range for vancomycin consumption in 2019 was 51 to almost 26 000 DOTs, as compared to daptomycin consumption of 4–1564 DOTs.

A total of 239 patients received at least 1 dose of vancomycin and were included: 144 were eligible to receive daptomycin and 95 were not. The median age and actual body weight were 59 (interquartile range [IQR], 44–73) years and 84 (IQR, 67–103) kg, respectively, and 134 (56%) patients were male. The median creatinine clearance was 60 (IQR, 35–95) mL/minute. The top 3 infections were respiratory tract infections (33%), skin/wound (26%), and bloodstream without endocarditis (21%). An organism was isolated in 79 (33%) patients, and methicillin-resistant *Staphylococcus aureus* (MRSA) was the most prevalent organism isolated (37%). The median duration of therapy was 4 (IQR, 2–6) days, and the median length of hospital stay was 8 (IQR, 5–14) days.

Among the 239 patients, a total of 2369.72 g of vancomycin was prescribed for 1147 days (~2 g per day). There were 390 vancomycin concentrations collected in 158 patients (66%) for a total cost of $74 100. Pharmacists wrote 599 progress notes in the electronic medical record and 688 assessments in a clinical decision support software program, amounting to 120 hours of time at a total cost of $7466.40. Twenty-four patients (10%) developed AKI that could have been associated with vancomycin, with 5 patients (21%) experiencing a total of 20 ICU stay days. Additionally, 4 patients required initiation of RRT at a total cost of $18 223.32. In the 144 patients eligible to receive

Table 2. Cost Minimization Analysis

Variable	Vancomycin Only (n = 239)	Daptomycin Eligible (n = 144) + Vancomycin Only (n = 95)	Difference
Drug only	$18 246.84	$57 893.54	($39 646.70)
Base solution only	$51 682.10	$24 574.25	$27 107.85
Drug concentrations + supplies	$74 100	$32 510	$41 590
Pharmacist oversight	$51 682.10	$24 574.25	$27 107.85
Total pharmacist time, hours	120	45.44	74.56
Total treatment cost	$151 495.34	$114 373.17	$37 122.17
Total treatment cost per patient	$633.87	$478.55	$155.32
Total hospital cost	$6 386 273.96	$6 346 502.22	$39 771.74
Total hospital cost per patient	$26 720.81	$26 554.40	$166.41

Costs are presented as United States dollars.

Table 3. Cost per Infection

Variable	Vancomycin Only	Daptomycin Eligible + Vancomycin Only	Difference
Central nervous system (n = 9)	$204 037.07	NA	NA
Bloodstream (n = 50)	$1 518 841.98	$1 503 850.71	$14 991.27
Bone/joint (n = 9)	$232 207.73	$230 973.43	$1234.30
Endocarditis (n = 1)	$30 607.57	$29 496.97	$1110.60
Respiratory tract (n = 78)	$2 015 835.37	NA	NA
Skin/soft tissue/wound (n = 62)	$1 392 132.85	$1 374 861.85	$17 271
Intra-abdominal (n = 19)	$639 334.19	$636 168.03	$3166.16
Urinary tract/gynecologic (n = 30)	$812 744.15	$808 867.15	$3877
Other (n = 17)	$398 745.62	$395 787.84	$2957.78

Costs are presented as United States dollars.

Abbreviation: NA, not applicable.

daptomycin, an estimated 535.37 g of daptomycin would have been administered at a total cost of $50 325.21. An estimated 55 CK concentrations would have been collected, costing $1540.

The total treatment cost for 239 patients to receive vancomycin was $151 495.34. The total treatment cost for 144 patients to receive daptomycin combined with the 95 patients receiving vancomycin was $114 373.17, resulting in an excess treatment cost of $37 122.17. This equates to a potential cost savings of $155.32 per patient. Additionally, the total pharmacist time spent would decrease from 120 hours (239 patients receiving vancomycin) to 45.44 hours (144 patients receiving daptomycin), resulting in a potential savings of 74.56 hours and $4639.02 (Table 2). When breaking cost down by infection, the differences become more noticeable (Table 3). All infections demonstrate a cost savings, including those that had patients with multiple infection locations that would preclude the use of daptomycin.

DISCUSSION

Vancomycin remains a mainstay of therapy in many institutions for the treatment of serious gram-positive infections. While there is clinical evidence to support the change from trough-based dosing and monitoring to an AUC-based approach [19], there are logistical and financial challenges to widespread implementation of AUC-based monitoring, including type of calculator required, necessity for widespread training of clinicians responsible for dosing, and workflow impact of the switch on prescribers [20]. However, vancomycin resistance has been rare within MRSA over a number of decades despite ubiquitous use empirically in most institutions. As facilities evaluate these changes to dosing but not resistance development, the future utility and use of vancomycin should be considered. Conversely, should institutions switch to daptomycin therapy as the primary anti-MRSA workhorse, the development of resistance long term should be monitored closely, as most use to date has been for definitive therapy for patients with MRSA or vancomycin-resistant enterococcal infections.

Our multicenter, retrospective cost minimization study demonstrated that of 239 patients who received vancomycin, 144 would have been eligible to receive daptomycin based on indication. If these patients had received daptomycin, the total estimated cost to treat the cohort would have been reduced by approximately $37 122.17. Most of the cost savings would be from the reduction in obtaining vancomycin concentrations and base solution used. While vancomycin concentrations are not directly related to the pharmacy department, there is still a cost savings demonstrated within the facility.

In conclusion, utilizing daptomycin in indication-specific patients could result in cost and time savings to institutions. This should be considered in analysis of vancomycin use and monitoring, especially for facilities that have transitioned, or are considering transition, to AUC-based dosing strategies.

Notes

Potential conflicts of interest. All authors: No reported conflicts.

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