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Short Communication

Dalbavancin use in an academic medical centre and associated cost savings

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ABSTRACT

Dalbavancin is a lipoglycopeptide antibiotic with unique weekly dosing active against Gram-positive organisms. This retrospective study included 37 patients receiving a mean of 2.7 weeks of dalbavancin. Nine patients (24%) were re-admitted to the hospital within 30 days. A total of 617 hospital days were saved, estimated to result in US$1 495 336 in savings and a mean cost avoidance of US$40 414 per patient. Dalbavancin provides a valuable antibiotic option that may minimise healthcare expenditure.

1. Introduction

Dalbavancin is a lipoglycopeptide antibiotic active against Gram-positive organisms, with a half-life of 346 h resulting in an extended dosing interval, approved for use in acute bacterial skin and skin-structure infections [1,2]. Use of a long-acting antimicrobial agent offers considerable quality-of-life benefits for patients with more chronic infections, such as eliminating the need for a central line, minimising the need for laboratory monitoring, and avoiding the inconvenience of daily infusions. Dalbavancin provides a valuable alternative in patient populations in which discharge from the hospital with a central line is not ideal. Despite the theorised benefits of treatment with a long-acting antibiotic, limited data exist for the treatment of osteomyelitis, bacteraemia and endocarditis [3–6].

2. Methods

The purpose of this study was to describe the use of dalbavancin at our institution and to estimate the associated cost avoidance. This retrospective chart review included patients aged ≥18 years receiving at least one dose of dalbavancin, identified via medication records, regardless of setting. The study was approved by the Oregon Health and Science University Institutional Review Board (Portland, OR, USA).

Cost containment was calculated using the sum of days the patient was not admitted to hospital within the dalbavancin therapeutic window. Dalbavancin duration was calculated using the following assumptions based on currently available pharmacokinetic data: 1500 mg = 2 weeks; 1000 mg + 500 mg (or renally adjusted equivalent) = 1 week for each dose, 1000 mg × 1 = 7–10 days (used infectious diseases physician's stated duration). The cost to the hospital for additional stay per day was estimated based on average spend for a patient on a medical or surgical floor, without a stay in the intensive care unit. Cost estimates include direct costs, such as pharmacy, nursing, imaging and laboratory expenses, but exclude indirect costs related to hospital overheads and management that are not directly associated with the individual patient's hospital course.

3. Results and discussion

Patient and treatment characteristics are summarised in Table 1. A total of 37 patients were included between April 2015 and October 2018. The mean patient age was 48.6 years (range 18–86 years) and 14 patients (38%) were female. The causative organism was most commonly methicillin-resistant *Staphylococcus aureus* (MRSA) (38%), followed by methicillin-susceptible *S. aureus* (24%) and coagulase-negative staphylococci (11%), with a single case of *Corynebacterium jeikeium*. Seven patients were treated with concurrent antibiotics due to polymicrobial infection; organisms not covered by dalbavancin included *Pseudomonas aeruginosa* and *Escherichia coli*. These patients were treated concurrently with oral fluoroquinolones, plus oral metronidazole when the treating

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Table 1
Patient and treatment characteristics ($n = 37$).

Variable	n (%)[a]
Age (years) (mean ± S.D.) [range]	48.6 ±14.5 [18–86]
Female sex	14 (38)
History of renal dysfunction	8 (22)
History of hepatic dysfunction	12 (32)
History of cardiovascular disease	12 (32)
History of IVDU	16 (43)
Indication	
Osteomyelitis	11 (30)
Skin and soft-tissue infection	8 (22)
Joint infection	4 (11)
Uncomplicated bacteraemia	5 (14)
Complicated bacteraemia	7 (19)
Endocarditis	2 (5)
Organism	
MRSA	14 (38)
MSSA	9 (24)
CoNS	4 (11)
Corynebacterium jeikeium	1 (3)
Polymicrobial	7 (19)
No culture data	2 (5)
Dalbavancin dosing regimen	
1500 mg × 1	10 (27)
1500 mg × 2	6 (16)
1000 mg × 1	10 (27)
1000 mg weekly	1 (3)
1000 mg × 1, 500 mg weekly	9 (24)
760 mg × 1, 375 mg × 1	1 (3)
Treatment setting[b]	
Inpatient	20
Infusion centre	13
Home infusion	4
Correctional facility	1

S.D., standard deviation; IVDU, intravenous drug use; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-susceptible *S. aureus*; CoNS, coagulase-negative staphylococci.
[a] Data are n (%) unless otherwise stated.
[b] A patient could be treated in more than one treatment setting.

Table 2
Rationale for dalbavancin selection.

Documented reason	n (%)[a]
History of intravenous drug use	14 (38)
Substance abuse, not intravenous	1 (3)
Adverse event on alternate outpatient antibiotic	2 (5)
Contraindications to alternative antibiotic options	8 (22)
Prior history of contaminated/manipulated PICC	5 (14)
History of non-adherence	3 (8)
Lack of outpatient options/funding	4 (11)
Inability of patient to physically manage PICC	2 (5)
Patient refused PICC	1 (3)
Other social issues preventing PICC	3 (8)
Prior treatment failure	1 (3)
Unclear	1 (3)

PICC, peripherally inserted central catheter.
[a] Multiple reasons may have been provided by the treating physician for an individual patient.

Table 3
Dalbavancin outcomes and cost savings.

	n (%)[a]
Hospital length of stay (days) (mean ± S.D.) [range]	15.3 ± 15.6 [1–59]
Duration of dalbavancin therapy (mean)	2.7 weeks
Duration of antibiotic course (mean)	4 weeks
Concurrent antibiotics during dalbavancin course	9 (24)
Suppressive oral antibiotics after i.v. course	6 (16)
Lost to follow-up	4 (11)
Hospital days saved	617 days
30-day re-admission for any reason	9 (24)
30-day re-admission due to recurrence of infection or potential adverse effects of dalbavancin	2 (5)
Recurrence of infection (evidence of relapse noted in chart)	1 (3)
Adverse reaction	3 (8)
Total cost savings	US$1 495 336
Mean cost savings per patient	US$40 414

S.D., standard deviation; i.v. intravenous.
[a] Data are n (%) unless otherwise stated.

provider was concerned for anaerobic infection. Dalbavancin was most commonly used to treat osteomyelitis or skin and soft-tissue infections, but indications were variable including two courses of therapy for endocarditis.

A variety of dosing regimens were used (Table 1). Twenty patients (54%) received a single dose of dalbavancin. The mean duration of dalbavancin therapy was 2.7 weeks and the mean duration of the complete course of antibiotics was 4 weeks.

Dalbavancin was administered in a variety of settings, most commonly during inpatient admission (Table 1). Dalbavancin was selected for off-label use on a case-by-case basis for patients with limited therapeutic options in the outpatient setting using available clinical evidence. Documented reasons for dalbavancin selection by the infectious diseases provider are detailed in Table 2. The most common justification was concern for peripherally inserted central catheter (PICC) safety in patients with a history of intravenous drug use (IVDU). Other reasons for dalbavancin use included contraindications to alternative antibiotics, a lack of outpatient infusion options owing to financial constraints or home environment, and a history of non-adherence to outpatient intravenous antibiotics. Dalbavancin provides a unique therapeutic alternative for patients with social situations that make outpatient antibiotics less ideal. For people who inject drugs, theoretical concern over PICC line misuse has led to ongoing debate and, as a result, these patients are often denied an outpatient parenteral antimicrobial therapy (OPAT) course [7]. A recent literature review reported OPAT completion rates for people who inject drugs of 72–100% and a low incidence (0–2%) of patients with evidence of PICC tampering [8]. Although these data support OPAT in this population, other factors such as home safety and insurance coverage of skilled nursing facilities also play a role in these patients being able to complete OPAT courses. The current review included 16 patients (43%) with a reported history of IVDU who were successfully treated with dalbavancin. In general, administering antibiotics without the need for a central line has clearly demonstrated benefits, as OPAT patients have been shown to experience line complications at higher rates than adverse reactions to the antibiotic they receive [9].

Dalbavancin treatment outcomes are summarised in Table 3. Nine patients (24%) were re-admitted to the hospital within 30 days, although only two (5%) of these patients were re-admitted due to recurrence of infection or potential adverse effect of dalbavancin. Six patients (16%) were prescribed suppressive oral antibiotics after completing their course and 4 patients (11%) were lost to follow-up. Three patients had a documented adverse reaction to dalbavancin. One was reported as thrombophlebitis at the peripheral intravenous insertion site, although the patient was in a hypercoagulable state and the reaction was not solely attributed to dalbavancin. The second was a patient with history of allergic reaction to multiple antibiotics who reported pruritus after infusion and was given diphenhydramine but required no further treatment. A third patient who had previously developed immunoglobulin A (IgA) nephropathy on vancomycin returned to the emergency department with complaints of chest pain and was found to have an acute on chronic increase in serum creatinine, which returned to baseline with fluid administration. In our experience, the use of dalbavancin resulted in no attributable adverse effects.

A total of 617 hospital days were prevented with the use of dalbavancin for these 37 patients, calculated as described above. The cost to the hospital was estimated at US$2503 per day by

the institutional finance department based on average cost for a patient on a medical or surgical floor. When the cost of dalbavancin is factored in, the total saving to the hospital is significant at an estimated US$1 495 336, with a mean cost savings per patient of US$40 414.

A retrospective study of dalbavancin use in 29 institutions in Spain reported 1160 hospital days saved for a total of 69 patients. Their cost savings estimate is based on the cost of dalbavancin compared with the cost of daptomycin, at an estimated savings of €3064 per patient [10]. Owing to the complexity of the US healthcare system, we believe cost savings estimates in our system are unique.

This study has several limitations. Due to the variability in included infections, conclusions regarding the efficacy of this antibiotic cannot be drawn. Furthermore, estimates of cost avoidance based on specific indications were not calculated. Variations in standard imaging and laboratory monitoring exist in the treatment of the included infections and were not factored into the costs.

4. Conclusions

This review suggests that dalbavancin is a well-tolerated therapy with significant implications for reducing length of hospital stay and cost savings compared with standard therapies. Further study is needed both on clinical outcomes in patients with complicated infections and on implications for healthcare resource use.

Declaration

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Ethical approval: This study was approved by the Oregon Health and Science University Institutional Review Board (Portland, OR, USA) [STUDY 00019086].

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