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Cost-Effectiveness of First-Line Sevelamer and Lanthanum versus Calcium-Based Binders for Hyperphosphatemia of Chronic Kidney Disease

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ABSTRACT

Background: Phosphate binders are used to treat hyperphosphatemia among patients with chronic kidney disease (CKD). **Objectives:** To conduct an economic evaluation comparing calcium-free binders sevelamer and lanthanum with calcium-based binders for patients with CKD. **Methods:** Effectiveness data were obtained from a recent meta-analysis of randomized trials. Effectiveness was measured as life-years gained and translated to quality-adjusted life-years (QALYs) using utility weights from the literature. A Markov model consisting of non–dialysis-dependent (NDD)-CKD, dialysis-dependent (DD)-CKD, and death was developed to estimate the incremental costs and effects of sevelamer and lanthanum versus those of calcium-based binders. A lifetime horizon was used and both costs and effects were discounted at 1.5%. All costs are presented in 2015 Canadian dollars from the Canadian public payer perspective. Results of probabilistic sensitivity analysis were presented using cost-effectiveness acceptability curves. Sensitivity analyses were conducted for risk pooling methods, omission of dialysis costs, and persistence of drug effects on mortality. **Results:** Sevelamer resulted in an incremental cost-effectiveness ratio of $106,522/QALY for NDD-CKD and $133,847/QALY for DD-CKD cohorts. Excluding dialysis costs, sevelamer was cost-effective in the NDD-CKD cohort ($5,847/QALY) and the DD-CKD cohort ($11,178/QALY). Lanthanum was dominated regardless of whether dialysis costs were included. **Conclusions:** Existing evidence does not clearly support the cost-effectiveness of non–calcium-containing phosphate binders (sevelamer and lanthanum) relative to calcium-containing phosphate binders in DD-CKD patients. Our study suggests that sevelamer may be cost-effective before dialysis onset. Because of the remaining uncertainty in several clinically relevant outcomes over time in DD-CKD and NDD-CKD patients, further research is encouraged.

Keywords: calcium carbonate, cost-benefit analysis, lanthanum, sevelamer.

Introduction

Phosphate binders are routinely prescribed for patients with chronic kidney disease (CKD) to manage hyperphosphatemia and reduce the risk of morbidity and mortality related to imbalances in biochemical parameters [1]. Among the choice of phosphate binders, calcium-based binders (including calcium carbonate and calcium acetate) are highly effective at reducing serum phosphorus and are inexpensive. Nevertheless, one caveat to their use is the higher incidence of hypercalcemia and increased coronary artery calcification [2]. Although calcium-free phosphate binders (including sevelamer, lanthanum, and iron-based binders) also effectively reduce phosphate levels and prevent hypercalcemia, they are significantly more expensive than calcium-based binders. To justify these costs, calcium-free phosphate binders should outperform calcium-based binders, particularly with respect to mortality and quality of life.

To date, the evidence ascribing the cost-effectiveness of calcium-free phosphate binders to their calcium-based counterparts among patients with CKD is insufficient [3,4]. A recent systematic review on cost-effectiveness analyses (CEAs) to evaluate the choice of phosphate binders in patients with CKD found that the results were highly inconsistent across studies [3]. Eight CEA studies compared sevelamer with calcium-based binders as a first-line treatment, but results varied widely from $2,201/QALY (quality-adjusted life-year) to $84,328/QALY in the base case (Table 1) [5–12]. Except one of these CEA studies [10], all the other studies used data from a single trial to obtain mortality estimates. In addition, no studies assessed the cost-effectiveness of lanthanum compared with calcium-based binders as a first-line treatment option.

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Table 1 – Summary of cost-effectiveness analyses comparing sevelamer with calcium-based binders.

Reference	Source of data for RR of sevelamer	Patient population	Health states	Perspective	Time horizon, discount	Includes dialysis and/or transplant costs		Excludes dialysis and/or transplant costs	
						$/QALY	$/LY	$/QALY	$/LY
Manns et al. [5]	Single RCT [2]	Chronic HD	Dialysis, transplant, death	Canadian single-payer	Lifetime, 5%	$170,611	–	$84,328	–
Thompson et al. [6]	Single RCT [4]	CKD	CKD, dialysis, death	UK NHS	Lifetime, 3.5%	$24,927	$18,992	$2,201	–
Bernard et al. [7]	Single RCT [2]	Chronic HD	Dialysis, death	UK NHS	Lifetime, 3.5%	$165,884	–	$43,616	$26,431
Ruggeri et al. [8]	Single RCT [7]	Incident HD	Dialysis, death	Italy NHS	3 y, 0%	–	$43,427	–	$6,542
Ruggeri et al. [9]	Single RCT [4]	CKD	CKD, dialysis, death	Italy NHS	3 y, 0%	–	Dominant	–	Dominant
Nguyen et al. [10]	Meta-analysis of RCTs from 2013 [10]	CKD	CKD, dialysis, death	Singapore, third-party payer	Lifetime, 3.5%	$48,838	–	–	–
Yang et al. [11]	Single RCT [2]	Chronic dialysis	Dialysis, death	China, payer*	Lifetime, 3.5%	–	–	$11,776	$9,044
Cho et al. [12]	Single observational study [12]	Chronic dialysis	Dialysis, death	South Korea NHIS	Lifetime, 5%	–	–	$12,475	$7,860
Current study	Meta-analysis of RCTs from 2016 [13]	CKD	CKD, dialysis, death	Canadian single-payer	Lifetime, 1.5%	$106,520	$77,001	$5,847	$4,227
Current study	Meta-analysis of RCTs from 2016 [13]	Chronic HD	Dialysis, death	Canadian single-payer	Lifetime, 1.5%	$133,847	$93,693	$11,178	$7,825

Note. All costs are represented in 2015 Canadian dollars.

CKD, chronic kidney disease (not yet on dialysis); HD, hemodialysis; LY, life-year; NHIS, National Health Insurance Service; NHS, National Health Service; QALY, quality-adjusted life-year; RCT, randomized controlled trial.

* With 30% co-payment.