Serum and Dialysate Potassium Concentration and Risk of Peridialytic Cardiac Arrest Among Outpatient Hemodialysis Patients

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Introduction:

- Sudden Cardiac Arrest (SCA) is the single most common cause of death in hemodialysis patients.
- SCA is temporally related to the dialysis procedure, and 14% of all SCA is estimated to occur in dialysis clinics.
- Prior studies have suggested risk associations with pre-dialysis hyperkalemia but also with exposure to low potassium dialysate.
- Therefore, the ideal management of pre-dialysis hyperkalemia is uncertain.

Study objective: To examine the influence of serum and dialysate potassium concentration on the risk of peridialytic cardiac arrest.

Methods:

- *Patient Population:* 43,200 prevalent hemodialysis patients dialyzing in 565 clinics of DaVita Inc. (formerly Gambro Healthcare clinics) in the United States between 2002-2005.
- *Study Design*: Nested Case-Control. We previously identified 783 patients who had a witnessed in-clinic SCA. Each SCA case patient with 3 random control patients matched by age, dialysis vintage, and year of event. Cohorts further limited to patients with at least 90 days of treatment data prior to event.
- *Data Source:* Clinical Event Reporting database (Electronic Record Management System:ERMS) to adjudicate in-clinic SCA events. Laboratory data, comorbid conditions extracted from clinical database, available billing codes and dialysis run sheets.
- *Study Design/Statistical Analysis:*
  - Data from 64,400 dialysis treatments compared between cohorts
  - Repeated measures summarized over 90 day period leading up to event
  - Multivariate logistic regression models used in adjusted analysis.

Figure 1: Study Design

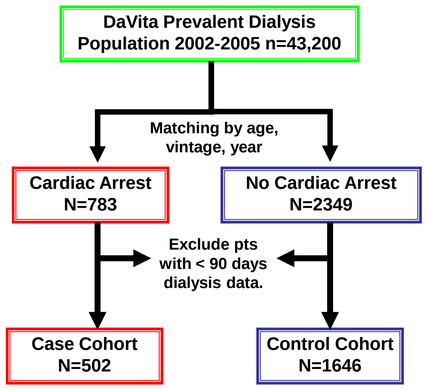


Table 1: Baseline Characteristics of the Study Cohorts

Variable	Case Cohort	Control Cohort	P Value
Median Age	65	66	NS
Median Number of years on dialysis	2.85	2.71	NS
% Male	52.5	52.2	NS
% White	46.6	42.5	NS
% Coronary Artery Disease	36.1	30.3	0.01
% History of CHF	39.8	31.7	<0.001
% History of Arrhythmia	13.6	11.8	NS
% History of Diabetes	57.4	53.9	NS
% Hypertension	87.1	87.4	NS
% Hyperlipidemia	8.2	6.4	NS
% Peripheral Vascular Disease	20.5	18.9	NS
% Cerebrovascular Disease	13.0	10.8	NS
% Tobacco Use	2.6	3.7	NS
Predialysis Potassium (last recorded (meq/L)	4.7	4.8	NS
% Last Treatment using Dialysate [K] < 2 meq/L	19.3	11.4	<0.0001
% All treatments using Dialysate [K] < 2 meq/L	16.2	8.7	<0.0001
Dialysis dose (urea reduction ratio)	0.72	0.72	NS
Dialysis catheter access (%)	33	34	NS

Results

Figure 2: Unadjusted Relationship between Pre-Dialysis Serum Potassium and SCA Risk

Dashed lines indicated 95% confidence intervals)

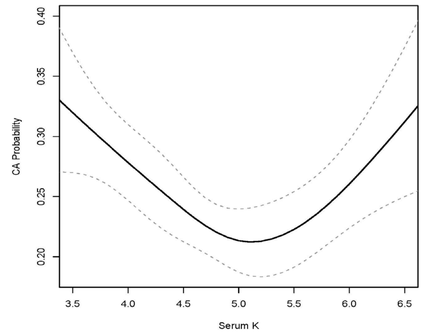


Figure 3: SCA Risk associated with Low (<2 meq/L) and High (≥2 meq/L) K dialysate

Dashed lines indicated 95% confidence intervals)

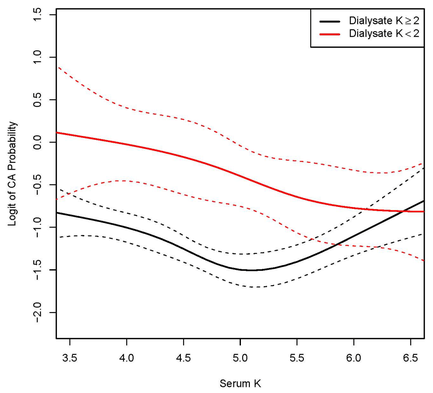


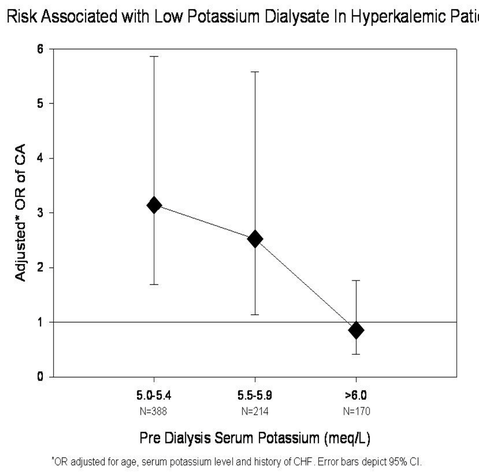
Table 2: Case Mix/Comorbidity Adjusted Odds Ratios for SCA

Variable	OR	95% CI
Dialysate K < 2 meq/L on last visit	2.12	1.55, 2.89
Pre-dialysis serum potassium		
OR per 1 meq/L decrease below 5.1 meq/L	1.49	1.19,1.89
OR per 1 meq/L increase above 5.1 meq/L	1.38	1.03,1.86

Adjusted for gender, race, history of CHF, DM, CAD, HL, history of arrhythmia, tobacco use, medication use (aspirin, ACEI/ARB, beta-blockers, statins, antiarrhythmics) last recorded creatinine, albumin, calcium, phosphorus, last recorded urea reduction ratio, catheter use). Overall model c-statistic 0.70

Figure 4: SCA Risk Associated with Low K dialysate in Hyperkalemic Patients

Error bars indicate 95% confidence intervals



*OR adjusted for age, serum potassium level and history of CHF. Error bars depict 95% CI.

Summary:

- **Both hyperkalemia and hypokalemia are associated with increased risk of SCA.**
- **Use of low K dialysate (<2 meq/L) continues to be prevalent in contemporary dialysis clinics and is strongly associated with increased SCA risk.**
- **Management of hyperkalemia with low K dialysate did not produce any significant reduction in SCA risk.**
- **Our data do not support the use of low K dialysate <2 meq/L even among hyperkalemic patients for reduction of SCA risk.**

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