Prevalence of Hyperkalemia in DOPPS: A Real-World, International Cohort of Hemodialysis Patients

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Introduction

- Hyperkalemia is common among patients with chronic kidney disease (CKD)[1] and is associated with poor outcomes including cardiac electrophysiological disorders and sudden death, especially in patients with CKD[2]
- The regional prevalence of hyperkalemia is poorly defined, and better understanding of where hyperkalemia occurs may guide public health improvements
- Here, we report regional variations in hyperkalemia prevalence, overall and by hyperkalemia severity, among patients with CKD who underwent in-center hemodialysis (HD) from the multiphase, real-world Dialysis Outcomes and Practice Patterns Study (DOPPS)

Methods

- DOPPS is a large, international, prospective, observational study of patients undergoing HD currently ongoing in North America (US and Canada), Europe (Belgium, France, Germany, Italy, Spain, Sweden, and the UK), Australia, New Zealand, Russia, Turkey, countries in the Gulf Cooperation Council, and Asia (China and Japan)
- Patients receiving in-center HD were included if they participated in DOPPS phases 2–5 (2002–2015): phase 2 (2002–2004); phase 3 (2005–2008); phase 4 (2009–2011); phase 5 (2012–2015)
- Patients were stratified based on the following baseline parameters:
  - Length of time on HD at DOPPS study entry: short-term (ST) HD (≤120 days [predialysis]) versus long-term (LT) HD (>120 days)
  - Geographical region: North America (US and Canada), Europe/Australia/New Zealand, and Japan
  - DOPPS phase
  - Renin–angiotensin–aldosterone system inhibitor (RAASi) prescription (eg, angiotensin-converting enzyme inhibitor, angiotensin receptor blocker, renin inhibitor, or aldosterone antagonist): yes versus no
  - Serum K^+ concentration: ≤5.0, >5.0–≤5.5, >5.5–6.0, and >6.0 mmol/L
- Statistical analyses:
  - Prevalence was calculated for the overall hyperkalemia population and by hyperkalemia severity, DOPPS phase, region, and RAASi prescription use

Results

- DOPPS phases 2–5 (2002–2015) included 11,710 patients undergoing ST HD and 37,852 patients undergoing LT HD (**Table 1**)
  - There were few differences across regions or between patients with or without RAASi prescriptions in either the ST or LT HD population. Exceptions were the use of K^+-binding resins and β-blockers, which varied between regions
  - The median (interquartile range) time on dialysis was 45 (10–82) days for patients with ST HD and 3.1 (1.3–6.5) years for patients with LT HD

Table 1. Baseline Patient Characteristics and Demographics for ST and LT HD Populations by Region

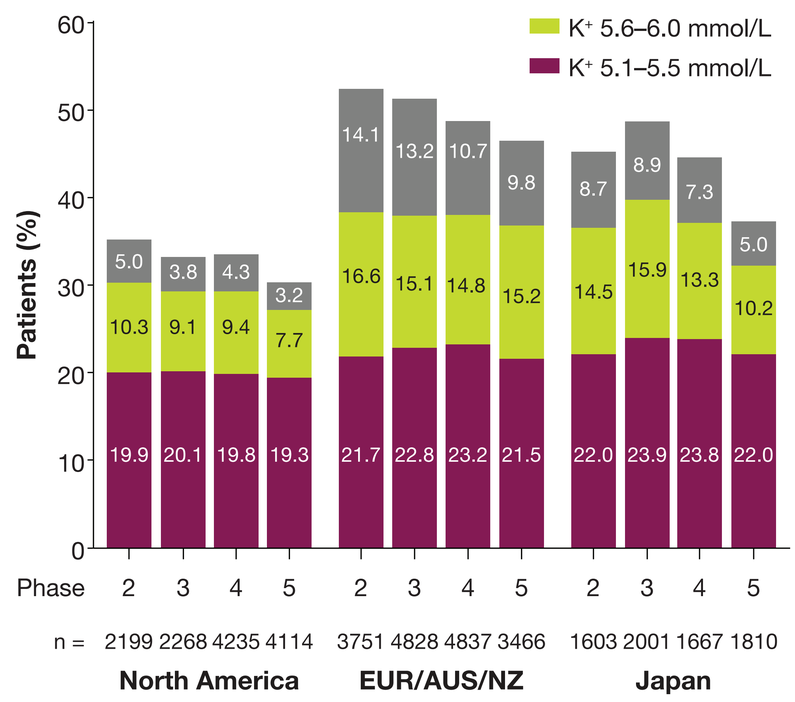
	Short-Term HD		
	North America (n = 4516)	Europe/Australia/ New Zealand (n = 5677)	Japan (n = 1517)
Patient characteristics			
Age, years, mean (SD)	63.2 (15.1)	65.2 (14.6)	65.1 (13.1)
Male, %	58	63	68
Black, %	22	2	0
Duration on HD, days, median (IQR)	50 (14–84)	40 (4–79)	44 (12–82)
HD-related characteristics			
Central venous catheter use, %	69	45	9
Single pool Kt/V, mean (SD)	1.4 (0.4)	1.3 (0.4)	1.0 (0.3)
Treatment time, minutes, mean (SD)	218 (33)	221 (40)	208 (37)
Dialysate K^+, mmol/L, mean (SD)	2.4 (0.6)	2.4 (0.8)	2.0 (0.1)
Laboratory and biometric measurements, mean (SD)			
Body mass index, kg/m^2	28.1 (6.9)	26.2 (5.5)	21.8 (3.5)
Predialysis SBP, mmHg	145 (23)	143 (22)	150 (22)
Hemoglobin, g/dL	10.8 (1.5)	10.5 (1.6)	9.6 (1.6)
Serum creatinine, mg/dL	6.3 (2.8)	6.7 (2.5)	7.9 (2.7)
Serum albumin, g/dL	3.5 (0.6)	3.5 (0.6)	3.4 (0.6)
Serum bicarbonate, mEq/L	23.4 (3.8)	22.9 (3.8)	21.4 (4.0)
Serum calcium, mg/dL	8.7 (0.8)	8.8 (0.9)	8.2 (0.8)
Serum phosphorus, mg/dL	5.1 (1.7)	5.2 (1.8)	5.3 (1.5)
Serum K^+, mmol/L	4.5 (0.7)	4.7 (0.8)	4.5 (0.8)
Medications, %			
RAASi use, n (%)	1574 (35)	2299 (40)	800 (53)
K^+-binding resin	1	8	6
β-blocker	61	46	21
Diuretic	35	54	57
Comorbid conditions, %			
Coronary artery disease	44	39	26
Cancer (non-skin)	13	17	10
Cerebrovascular disease	13	15	13
Heart failure	37	26	29
Diabetes	61	39	51
Hypertension	87	86	85
Peripheral vascular disease	24	26	12
Other cardiovascular disease	25	30	22

	Long-Term HD		
	North America (n = 13,290)	Europe/Australia/ New Zealand (n = 17,446)	Japan (n = 7116)
Patient characteristics			
Age, years, mean (SD)	61.8 (15.1)	64.2 (14.9)	63.0 (12.5)
Male, %	55	60	62
Black, %	29	2	0
Duration on HD, years, median (IQR)	2.7 (1.2–5.3)	2.9 (1.2–6.1)	5.2 (2.0–10.7)
HD-related characteristics			
Central venous catheter use, %	25	22	1
Single pool Kt/V, mean (SD)	1.6 (0.3)	1.5 (0.3)	1.4 (0.3)
Treatment time, minutes, mean (SD)	220 (34)	243 (38)	238 (30)
Dialysate K^+, mmol/L, mean (SD)	2.1 (0.6)	2.1 (0.7)	2.0 (0.1)
Laboratory and biometric measurements, mean (SD)			
Body mass index, kg/m^2	28.0 (6.9)	25.6 (5.4)	21.0 (3.3)
Predialysis SBP, mmHg	148 (23)	139 (23)	149 (22)
Hemoglobin, g/dL	11.4 (1.3)	11.5 (1.5)	10.4 (1.3)
Serum creatinine, mg/dL	8.4 (3.0)	8.3 (2.7)	10.7 (2.9)
Serum albumin, g/dL	3.8 (0.5)	3.7 (0.5)	3.8 (0.4)
Serum bicarbonate, mEq/L	23.4 (3.4)	22.7 (3.2)	20.4 (3.0)
Serum calcium, mg/dL	9.1 (0.8)	9.2 (0.9)	9.0 (0.9)
Serum phosphorus, mg/dL	5.4 (1.7)	5.2 (1.7)	5.5 (1.5)
Serum K^+, mmol/L	4.8 (0.7)	5.1 (0.8)	5.0 (0.8)
Medications, %			
RAASi use, n (%)	5536 (42)	6017 (34)	3122 (44)
K^+-binding resin	2	18	12
β-blocker	58	39	18
Diuretic	19	31	26
Comorbid conditions, %			
Coronary artery disease	47	43	31
Cancer (non-skin)	12	15	10
Cerebrovascular disease	15	17	14
Heart failure	39	28	20
Diabetes	57	33	35
Hypertension	87	82	75
Peripheral vascular disease	25	31	16
Other cardiovascular disease	27	37	29

HD, hemodialysis; IQR, interquartile range; K^+, potassium; Kt/V, clearance of urea multiplied by dialysis time (ie, the volume of plasma cleared of urea) divided by the distribution volume of urea; RAASi, renin–angiotensin–aldosterone system inhibitor; SBP, systolic blood pressure; SD, standard deviation.

- Hyperkalemia was more prevalent among patients receiving dialysis for >120 days (LT HD; **Figure 1A**) versus ≤120 days (ST HD; **Figure 1B**)
- For both patients receiving ST or LT HD, hyperkalemia prevalence was higher in Europe/Australia/New Zealand compared with North America and Japan
- Serum K^+ >5.5 mmol/L was more common among patients in Europe/Australia/New Zealand compared with those in North America and Japan. Low proportions of patients undergoing ST HD (≤4%) experienced serum K^+ >6.0 mmol/L outside of Europe/Australia/New Zealand
- The prevalence of mild hyperkalemia was comparable by region and duration of dialysis
- Within each region, minimal differences in prevalence were observed across the DOPPS phases 2–5

Figure 1. Prevalence of Hyperkalemia Varied by DOPPS Phase, Region, and Serum K^+ for Patients Undergoing (A) LT and (B) ST HD



EUR/AUS/NZ, Europe/Australia/New Zealand; K^+, potassium.

Strengths

- DOPPS is a large, global, prospective, real-world study of patients undergoing HD

Limitations

- Analysis was restricted to patients receiving in-center HD at participating centers and therefore is not representative of patients receiving home HD or those in other countries
- The lower prevalence of hyperkalemia among patients receiving ST versus LT HD may be a result of preserved residual kidney function or the lower prevalence of RAASi use during the transition period to dialysis; however, this association was not examined in the current study
- Serum K^+ measurement practices may vary across regions
- Only descriptive results are presented, and no statistical comparisons were made

Conclusions

- Data from DOPPS demonstrate that hyperkalemia is highly prevalent among patients undergoing HD around the globe
  - Hyperkalemia prevalence was highest in Europe/Australia/New Zealand, followed by Japan and North America
  - The prevalence and severity of hyperkalemia are greater among patients undergoing HD for >120 days (LT HD) versus ≤120 days (ST HD)
- Hyperkalemia treatment practices differ among regions
  - The use of K^+-binding resins was less prevalent in North America
  - β-blockers may have an affect on serum K^+ level but are not a treatment for high K^+ levels
  - Differences in hyperkalemia treatment practices that affect hyperkalemia incidence and resolution should be further explored

References

1. Kovesdy CP. *Nat Rev Nephrol.* 2014;10(11):653–662.
2. National Kidney Foundation. https://www.kidney.org/content/clinical-update-hyperkalemia-chronic-risk-ckd-patients-and-potential-barrier-recommended-ckd. Accessed May 12, 2017.

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