

Hyperkalemia: Diagnosis and Treatment

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Table of Contents

- 1 Overview
 - Why Care
 - When to Care
 - Formal Definition
- 2 Therapies
 - Myocardial Stabilization
 - Pushing K Back In
 - Getting Rid of K
 - Preventing Recurrence
- 3 Conclusions
- 4 References

Why Care



Hyperkalemia and its Association with Mortality, Cardiovascular Events, Hospitalizations and ICU Admissions in a Population-based Retrospective Cohort

Cohort



Retrospective



Province of
Manitoba, Canada



Adults
Hyperkalemia
 $K^+ \geq 5.0$ mmol/L
n=93,667



2007-2016

Methods

1:1 propensity matched



Hyperkalemia

VS



No hyperkalemia



N = 88,541 each group



Sensitivity
analysis

$K^+ \geq 5.5$ mmol/L

Outcomes



Mortality

HR 1.15
(1.13-1.18)



CV events

HR 1.20
(1.14-1.26)



Hospital
admissions

HR 1.71
(1.68-1.74)



ICU
admissions

HR 3.48
(3.34-3.62)



Mortality

HR 1.66
(1.58-1.74)



CV events

HR 1.31
(1.17-1.45)

KIREPORTS
Kidney International Reports

Hougen et al, 2020

Visual abstract by:
Sophia Ambruso, DO

Conclusion In our population-based study, hyperkalemia was an independent risk factor for all-cause mortality, cardiovascular events, hospitalizations and ICU admissions.

Source:¹

¹Ingrid Hougen et al. "Hyperkalemia and its Association With Mortality, Cardiovascular Events, Hospitalizations, and Intensive Care Unit Admissions in a Population-Based Retrospective Cohort". In: *Kidney International Reports* 6.5 (May 2021), pp. 1309-1316. ISSN: 24680249. DOI: 10.1016/j.ekir.2021.02.038. URL: <https://linkinghub.elsevier.com/retrieve/pii/S2468024921001431>.

When to Care

- EKG changes

²Zubaid Rafique et al. "Can physicians detect hyperkalemia based on the electrocardiogram?" In: *The American Journal of Emergency Medicine* 38.1 (Jan. 2020), pp. 105–108. ISSN: 07356757. DOI: 10.1016/j.ajem.2019.04.036. URL: <https://linkinghub.elsevier.com/retrieve/pii/S0735675719302608>.

³Keith D Wrenn, Corey M Slovis, and Bonnie S Slovis. "The ability of physicians to predict hyperkalemia from the ECG". In: *Annals of Emergency Medicine* 20.11 (Nov. 1991), pp. 1229–1232. ISSN: 01960644. DOI: 10.1016/S0196-0644(05)81476-3. URL: <https://linkinghub.elsevier.com/retrieve/pii/S0196064405814763>.

⁴Brian T. Montague, Jason R. Ouellette, and Gregory K. Buller. "Retrospective Review of the Frequency of ECG Changes in Hyperkalemia". In: *Clinical Journal of the American Society of Nephrology* 3.2 (Mar. 2008), pp. 324–330. ISSN: 1555-9041.

When to Care

- EKG changes
 - peaked T waves
 - PR depression
 - bradycardia (!)
 - sinusoidal pattern (!!)

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 - study of ESRD pts getting emergent HD ($n = 317$)²
 - SEN 0.19, SPEC 0.97, PPV 0.92, NPV 0.46
 - Other studies were worse³

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- What about Cardiologists?⁴
 - $n = 90$ of $K \geq 6.0$
 - $n = 24$ had "T wave changes" (21 were non-specific)
 - $n = 3$ had "Peaked T waves" (3.33%)

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Formal Definition

ECG changes	+	Moderate	Severe	Severe
	-	Mild	Moderate	
		5.0*–5.9	6.0–6.4	≥6.5
Potassium concentration (mmol/l)				

Figure 4 | Severity of acute hyperkalemia: expert opinion-based risk classification. *5.0 or upper limit of normal range. ECG, electrocardiogram.

Clase CM et al. PMID 31706619

Source:⁵

⁵Catherine M. Clase et al. "Potassium homeostasis and management of dyskalemia in kidney diseases: conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference". In: *Kidney International* 97.1 (Jan. 2020), pp. 42–61. ISSN: 00852538. DOI: 10.1016/j.kint.2019.09.018. URL: <https://linkinghub.elsevier.com/retrieve/pii/S0085253819310129>.

What Works

- Myocardial Stabilization
- Push K Back In
- Get Rid of K
- Prevent Recurrence

Myocardial Stabilization

Clinical Pearls

- Saves lives!
- Gluconate vs Chloride
 - 1–3 g CaGluc or 1 g CaCl⁶
- Redosing?
 - Optimal regimen unknown⁷
 - Calcium only lasts for 30–60 min
 - Redose if unstable arrhythmia (brady, wide QRS)









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⁷Heather A. LaRue, Gary Daniel Peksa, and Shital C. Shah. "A Comparison of Insulin Doses for the Treatment of Hyperkalemia in Patients with Renal Insufficiency". In: *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy* 37.12 (Dec. 2017), pp. 1516–1522. ISSN: 02770008. DOI: 10.1002/phar.2038. URL: <https://onlinelibrary.wiley.com/doi/10.1002/phar.2038>.

Pushing K Back In

• Options

⁸M Allon, R Dunlay, and C Copkney. "Nebulized albuterol for acute hyperkalemia in patients on hemodialysis." In: *Annals of internal medicine* 110.6 (Mar. 1989), pp. 426–9. ISSN: 0003-4819. DOI: 10.7326/0003-4819-110-6-426. URL: <http://www.ncbi.nlm.nih.gov/pubmed/2919849>, M Allon and C Copkney. "Albuterol and insulin for treatment of hyperkalemia in hemodialysis patients." In: *Kidney international* 38.5 (Nov. 1990), pp. 869–72. ISSN: 0085-2538. DOI: 10.1038/ki.1990.284. URL: <http://www.ncbi.nlm.nih.gov/pubmed/2266671>.

⁹H H Liou et al. "Hypokalemic effects of intravenous infusion or nebulization of salbutamol in patients with chronic renal failure: comparative study." In: *American journal of kidney diseases : the official journal of the National Kidney Foundation* 23.2 (Feb. 1994), pp. 266–71. ISSN: 0272-6386. DOI: 10.1016/s0272-6386(12)80983-8. URL: <http://www.ncbi.nlm.nih.gov/pubmed/8311086>, A Mandelberg et al. "Salbutamol metered-dose inhaler with spacer for hyperkalemia: how fast? How safe?" In: *Chest* 115.3 (Mar. 1999), pp. 617–22. ISSN: 0012-3692. DOI: 10.1378/chest.115.3.617. URL: <http://www.ncbi.nlm.nih.gov/pubmed/10084465>        

Pushing K Back In

Options

- IV insulin \pm dextrose
- β_2 agonists
 - albuterol data is old (1980s–early 1990s)⁸
 - or is on IV salbutamol⁹
 - for unstable bradycardia \pm shock, use epinephrine drip
- if no hypervolemia, isotonic bicarb (D5W with 150 mEq/L NaHCO₃)
 - per old RCTs, bicarb *ampules* don't work

⁸M Allon, R Dunlay, and C Copkney. "Nebulized albuterol for acute hyperkalemia in patients on hemodialysis." In: *Annals of internal medicine* 110.6 (Mar. 1989), pp. 426–9. ISSN: 0003-4819. DOI: 10.7326/0003-4819-110-6-426. URL: <http://www.ncbi.nlm.nih.gov/pubmed/2919849>, M Allon and C Copkney. "Albuterol and insulin for treatment of hyperkalemia in hemodialysis patients." In: *Kidney international* 38.5 (Nov. 1990), pp. 869–72. ISSN: 0085-2538. DOI: 10.1038/ki.1990.284. URL: <http://www.ncbi.nlm.nih.gov/pubmed/2266671>.

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Getting Rid of K

Getting Rid of K



Preventing Recurrence

Preventing Recurrence



NDC 59212-075-01

K-450

Rx only

Kayexalate® sodium polystyrene sulfonate, USP

453.6 g (1 lb)

Read package insert.

Average adult dose: 15 g (approximately 4 level teaspoons) one to four times daily in water. See complete prescribing information.

The effect must be carefully controlled by frequent serum potassium determinations within each 24 hour period. Sodium content approximately 60 mEq per 15 g. Suspension should be freshly prepared and not stored beyond 24 hours. Dispense in tight, light-resistant containers as defined in the official compendia.

Store at 25°C (77°F); excursions permitted to 15°-30°C (59°-86°F) [see USP Controlled Room Temperature].

Mfd. for: Concordia Pharmaceuticals Inc.
St. Michael, Barbados
BB11005 Rev. 01/17
075017/LB/1

CONCORDIA
PHARMACEUTICALS



50093300C

Lot:
Exp:

Conclusions

- Diagnose
 - Don't use EKG to decrease your concern
- Myocardium
 - CaGluc or CaCl saves lives
- Temporize
 - IV insulin
 - IV diuretics
 - IV bicarb or LR
- Reduce recurrence
 - sodium zirconium cyclosilicate (Lokelma)

References

- [1] Ingrid Hougen et al. "Hyperkalemia and its Association With Mortality, Cardiovascular Events, Hospitalizations, and Intensive Care Unit Admissions in a Population-Based Retrospective Cohort". In: *Kidney International Reports* 6.5 (May 2021), pp. 1309–1316. ISSN: 24680249. DOI: 10.1016/j.ekir.2021.02.038. URL: <https://linkinghub.elsevier.com/retrieve/pii/S2468024921001431>.
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