Serum Potassium Abnormality (Normal 3.5-5 mEq/L = 50-120 mmol Potassium)

Hyperkalemia (>5.5 mEq/L)

Causes

Spurious Pseudohyperkalemia:**

*Ischemic blood draw

*leukocytosis >50,000 cm^3

*Thrombocytosis > 1,000,000/cm^3

Transcellular shift:

cellular release:

*Rhabdomyolysis

*Tumor lysis syndrome

*Intense exercise

ICF-ECF Exchange:

*Insulin deficiency

*Hypertonicity

*Beta 2 adrenergic blockade

*Succinylcholine

*Digitalis intoxication

*Fluoride intoxication

*Hyperkalemic periodic paralysis

*Inorganic acidosis

Impaired renal excretion of potassium:

*Decreased GFR <20 mL/min

*Endogenous production

Retention of metabolic waste

*Exogenous administration

Potassium rich food

Potassium supplement

Blood products

*Decrease Aldosterone effect

ACE inhibitors

ARBS

Potassium sparing diuretics

Type IV renal tubular acidosis (Diabetes mellitus, interstitial nephritis, UT obstruction)

Cyclosporine A

NSAIDs

LMWH

Ketoconazole, Trimethoprim, pentamidine

Hypokalemia (< 3.5 mEq/L)

Transcellular shift:

Alkalemia

Insulin excess

B2 Agonist / Stress

Theophylline

Barium intoxication

Hypokalemic periodic paralysis

Thyrotoxicosis

Hypothermia

Alcohol withdrawal

Myocardial infarction

Asthma attack

Causes [1]

Spurious* (Pseudohypokalemia:

Extreme leukocytosis (WBCs > 100,000/cm^3)

↓ Total Body K+

↓ k+ intake

↑ k+ losses

Extrarenal losses:

urinary k+ <20 mEq/L **or** Trans-tubular potassium gradient TTKG<3

Nasogastric suction

Vomiting

diarrhea

Renal Losses:

(Urinary k+ > 20 mEq/L **or** Trans-tubular potassium

According to blood pressure

Hypertensive

True Aldosterone effects:

- 1ry hyperaldos-teronism
- Renovascular or malignant HTN

Aldosterone–like effect:

- Cushing's Synd.
-Apparent mineralocorticoid excess
- Liddle's Synd.
-Congenital adrenal hyperplasia

Normotensive

Aldosteron 2ry elevated hypovolemia:

-aggressive diuretic use

-Bartter Synd.

-Gitelman Syndrom.

Hyperkalemia Onset [2]

Acute

Obtain K+ level, check vital signs and ECG, if patient stable, repeat K+ Level test to rule out pseudohyperkalemia

Severe

K+> 6.5 mEq/L

OR

K+ > 5.5 mEq/L with ECG changes

Mild to moderate

K+ = 5.5-6 mEq/L with No acute ECG changes or acute neuromuscular/ cardiac symptoms

Chronic

-asymptomatic patients with mild to moderate hyperkalemia

Give **Sodium polystyrene sulfonate**

PO: 15 g once daily or q6-12hr

Rectal: 30-50 g q6hr

The oral route is better tolerated and more effective than the rectal route.

The sorbitol component promotes excretion of exchanged potassium by inducing diarrhea.

discontinue hyperkalemia-inducing or potassium-containing medications.

Discontinue hyperkalemia-inducing or potassium-containing medications.

Any ECG changes or risk of unstable cardiac rhythm?

Yes

No

1- Administer calcium gluconate 10 ml IV over 10 min

2- Re-dose IV calcium if after 5 min ECG/telemetry shows signs of hyperkalemia

Duration of action ≥ 2h

Note: May increase cardiotoxicity of digoxin

Follow by

Note: Do not administer dextrose if serum glucose level > 250 mg/dL

-Administer insulin 10 U IV with 25 g to 50 g dextrose IV

-Onset of action: 15-30 min,

-Duration of action: ≥ 2h

May re-dose insulin if follow-up K+ not improved

Yes

Is Adjunctive treatment required?

Administer oral inhaled Albuterol 10-20 mg if possible (works in synergy with insulin and glucose)

No

Consider a loop diuretic or potassium binder to remove potassium from the body

Any kidney failure, life-threatening hyperkalemia, have treatment methods failed?

Yes

Hemodialysis

No

Consider a low-potassium diet and/or discontinuing or adjusting hyperkalemia-inciting and nephrotoxic medications

Hypokalemia Management [3]

Assess for life-threatening complications

(Bradycardia)

Yes

5-10 mEq Kcl over 15-20 min.

May repeat until symptoms are resolved

No

Assess K+ deficit if any

Generally each decrease 0.3 mEq in serum potassium = 100mEq total body deficit [4]

- K deficit = (K expected – K seen) * Wt in kg * constant value
- Constant value: It's either 0.4 (used when K expected is 3.5mEq/L) or 0.6 (used when K expected is 4mEq/L)
- Daily potassium requirement = 1 mEq /kilogram body weight.
- Potassium replacement = K deficit + daily K requirement

N.B: 1mmol/L = 1mEq/L

(< 2 mEq\L)

IV KCl 20–40 mEq/hr

Monitoring:

•continuous ECG monitoring.

•Serum K after each 40 mmol\ hr (every 1-2 hr) [3]

(2-2.5 mEq\L)

IV KCl 10–20 mEq/hr

Monitoring:

•continuous ECG monitoring.

•Serum K after each 40 mmol\ hr (every 1-2 hr) [3]

Potassium Chloride (KCl) IV Administration: [6]

Peripheral route:

• Maximum rate: 10 mEq / hour.

• Maximum concentration:

10 mEq /100 mL of normal saline.

Central route:

• Maximum rate:40 mEq / hour.

•Maximum concentration:

20-40 mEq / 100 ml of normal saline

N.B:

• NEVER USE IV OR IM OR SC BOLUS. [8]

• Infusion pump must be used.[8]

• Rates up to 40 mEq/hour OR 400 mEq / day can be administered very carefully when guided by continuous ECG monitoring and frequent serum K+ determinations

• KCL must always be administered by slow IV infusion, diluted in 0.9% NaCl or Ringer solution.

• Mix thoroughly by inverting at least 5 times the infusion bottle or bag.

Extravasation management:[6]

• Stop infusion immediately and disconnect (leave needle/cannula in place)

• Gently aspirate extravasated solution (do NOT flush the line)

• Initiate hyaluronidase antidote; remove needle/cannula.

• Apply dry cold compresses elevate extremity.

Hyaluronidase: Intradermal or SC: total of 1 to 1.7 mL (15 units/mL) as 5 separate 0.2- 0.3 mL injections (using a 25-gauge needle) into area

(2.5-3)mEq/L

Oral KCl 120 mEq/day (in divided doses)

Monitoring serum K:

Once \ day.[3]

(3-3.5)mEq/L

Oral KCl 40–80 mEq/day if no signs or symptoms (doses > 60 mEq should be divided to avoid GI adverse effects)

Monitoring serum K: Once \ day. [3]

Monitoring:

Once \ day

Potassium Chloride Oral Solution
Description: [5]

Solution 10%:

• 15 mL of solution →1.5 g KCL, ≈20mEq

• 1ml → 1.3 mEq KCL

•Oral Solution 20%:

(If available)

•15 ml of solution → 3.0 g KCL, ≈40mEq

•1ml → 2.6 mEq KCL

KCL extended-release tablets
Description:

•600 mg → 8 mEq [7]

•750 mg → 10 mEq

(If available) [6]

N.B: [6]

•Dosages >40 mEq\ day should be divided.

•Maximum 40 mEq is given in a single dose.

•The total daily dose should not exceed 200 mEq in a 24 hour period.

•should be taken with meals and a full glass of water or other liquid to minimize the risk of GI irritation.

• Swallow tablets whole; do not crush, chew, or suck on tablet

**Spurios hyperkalemia: (Pseusohyperkalemia)

Elevation in the measured K concentration due to K movement out of the cells (erythrocytes, leukocytes or platelets) either during or after drawing of the blood specimen. The presence of pseudohyperkalemia should be strongly suspected whenever hyperkalemia and hemolysis, extreme leukocytosis or thrombocytosis coexist.

*Spurios Hypokalemia: (Pseudohypokalemia)

In leukemic patients with a very high white cell count (>100,000/µl), the K movement into leukocytes may result in spurious hypokalemia if blood samples are stored for prolonged period at room temperature.

References:

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