



**Department of  
Anesthesia  
Techniques  
*Electrolyte  
imbalance:***



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# *Electrolyte imbalance:*

**Potassium:** normal level 3.5-5.2 mmol/L

## **- Potassium Deficit (Hypokalemia):**

### **– Causes :**

- \* Diarrhea, vomiting, gastric suction.
- \* Corticosteroid administration.
- \* Diuretics.

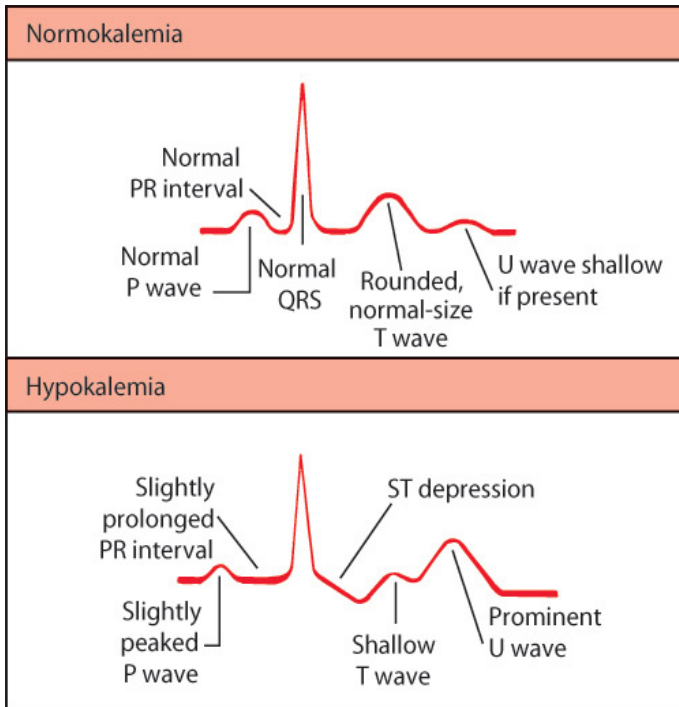
### **– Signs and symptoms:**

Fatigue, anorexia, nausea, vomiting, muscle weakness, change in ECG.

- **ECG: low, flat T-waves, ST depression, and U waves**

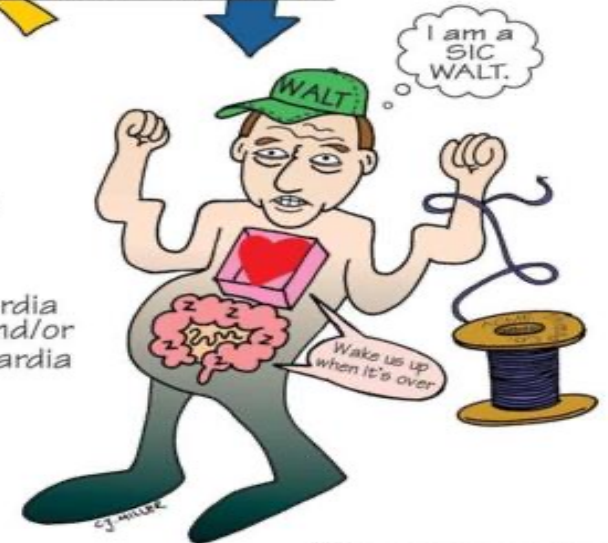
# Hypokalemia, continued

- ECG changes in hypokalemia



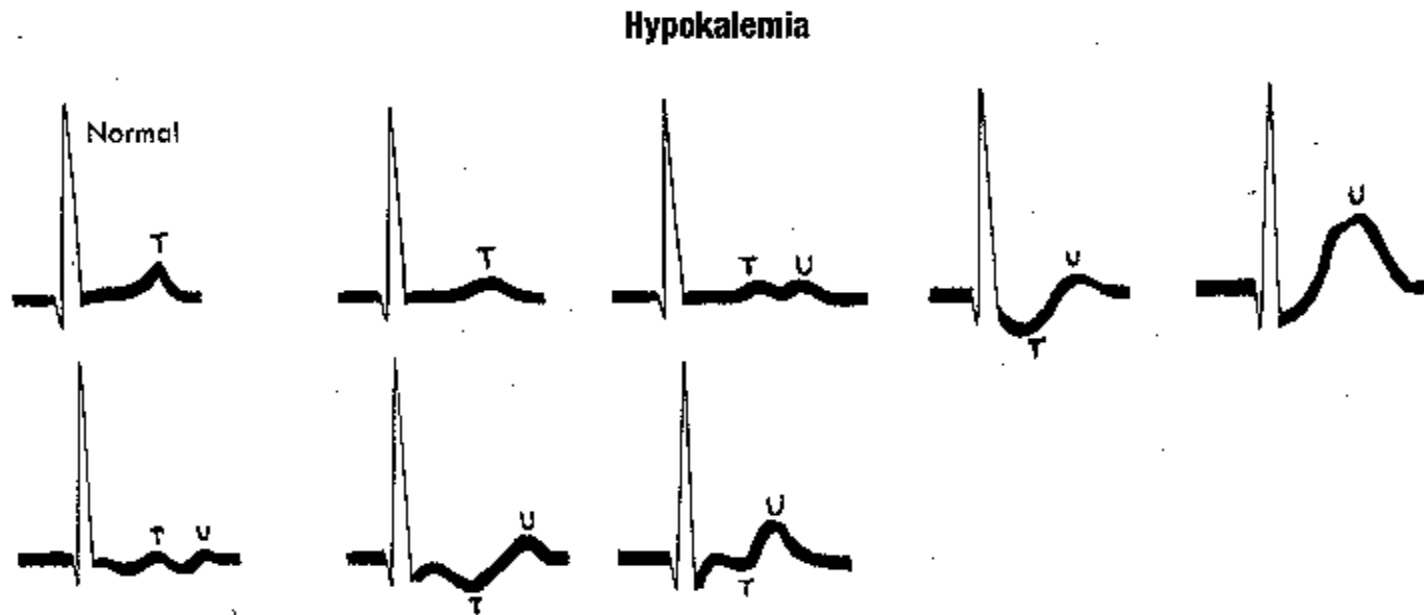
**K<sup>+</sup>**  
**POTASSIUM DEFICIT**

- \* **A**lkalosis
- \* **S**hallow Respirations
- \* **I**rritability
- \* **C**onfusion, Drowsiness
- \* **W**eakness, Fatigue
- \* **A**rrhythmias - Tachycardia  
Irregular Rhythm and/or  
Bradycardia
- \* **L**ethargy
- \* **T**hready Pulse
- \* **↓** Intestinal Motility  
Nausea  
Vomiting  
Ileus



# Hypokalemia, continued

- ECG changes in hypokalemia



# Hypokalemia

- Treatment:
  - Check renal function before administration of Potassium
  - Treat alkalosis, decrease sodium intake
  - Oral potassium 20-40 mEq
  - IV: peripheral 7.5 mEq/hr,
  - or central 20 mEq/hr
  - and increase K<sup>+</sup> in maintenance fluids.

# *Electrolyte imbalance:*

## ***Potassium Excess (Hyperkalemia):***

### ***– causes :***

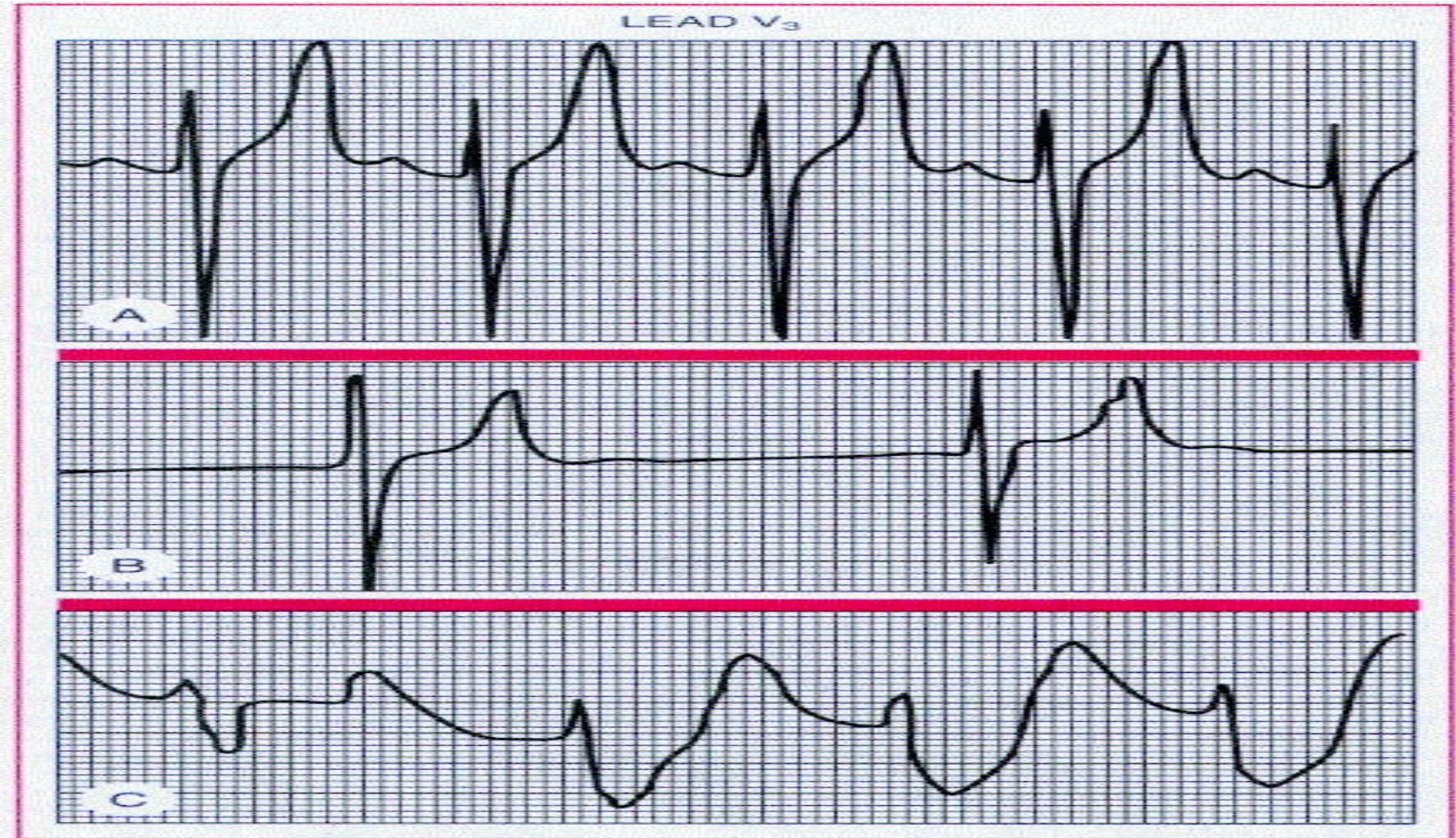
- \* Renal Failure.
- \* Crush injury, burns.
- \* Blood transfusion.
- \* Administration of IV K+.

### ***– Signs and Symptoms:***

Bradycardia, dysarrhythmia, anxiety, irritable.

**– ECG: peaked T waves then flat P waves, depressed ST segment, widened QRS progressing to sine wave and V fib.**

# Hyperkalemia – ECG Changes



# Hyperkalemia, continued

- Treatment:
  - Remove iatrogenic causes
  - Acute: if  $> 7.5$  mEq/L or ECG changes
    - **Ca-gluconate** – 1 gm over 2 min IV
    - **Sodium bicarbonate** – 1 amp, may repeat in 15min
    - **D50W and 10U regular insulin**
    - **dialysis**



# Calcium

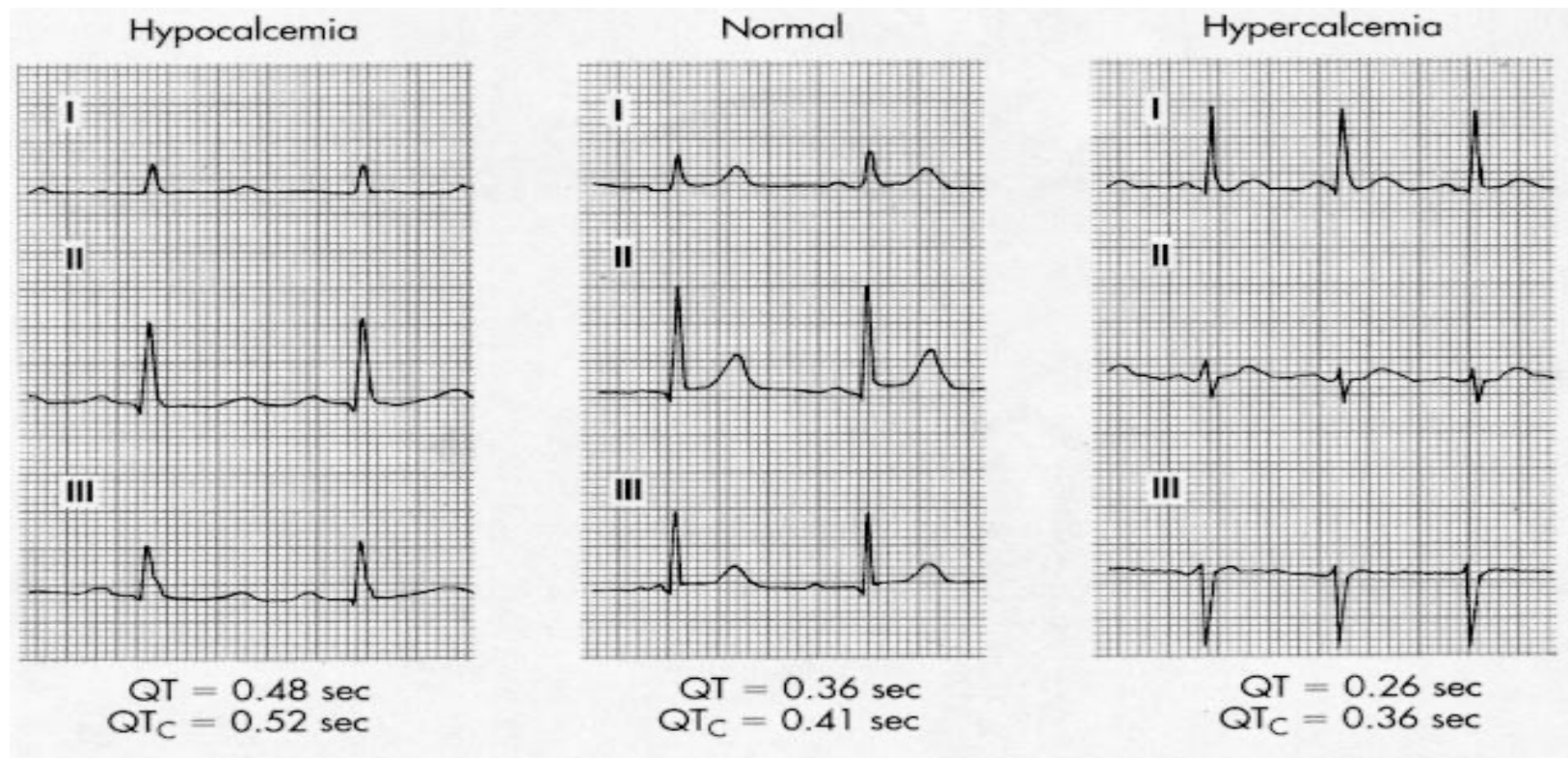
normal level 8.5-10.2 mg/dl

- **Hypocalcemia:**

- Seen in hypoalbuminemia. Check ionized Ca
- Often symptomatic below 8 mEq/dL
- Check PTH:
  - low may be Mg deficiency
  - High think pancreatitis, hyperPO<sub>4</sub>, low Vitamin D, pseudohypoparathyroidism, massive blood transfusion, drugs (e.g. gentamicin) renal insufficiency
- Signs and symptoms: numbness, tingling, circumoral paresthesia, cramps tetany, Chvostek's sign, Trousseau's sign
  - **ECG has prolonged QT interval**



## ECG Changes in Calcium Abnormalities



# Hypocalcemia

- Treatment:
  - Acute: **(IV) CaCl 10 cc of 10% solution = 6.5 mmole Ca**  
or **CaGluconate 10cc of 10% solution = 2.2 mmole Ca**
  - Chronic: (oral) 0.5-1.25 gm  $\text{CaCO}_3$  = 200-500 mg Ca.
    - **Vit D (calciferol)** . Start 50,000 – 200,000 units/day

# Hypercalcemia

## Causes:

- secondary to hyperparathyroidism or malignancy.
- thiazides diuretics
- acute adrenal insufficiency
- Acute crisis is serum Ca > 12mg/dL. Critical at 16-20mg/dL
- Signs and symptoms: nausea and vomiting , anorexia, abdominal pain, confusion

# Calcium, continued

## **Treatment:**

- **Hydration with NS then loop diuretic.**
- **Steroids**
- **Hemodialysis.**
- **Calcitonin**