



**SNS COLLEGE OF ALLIED HEALTH SCIENCES**

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



**DEPARTMENT OF CARDIAC TECHNOLOGY- II YEAR**

**UNIT IV : ELECTROLYTIC AND METABOLIC IMBALANCE ECG**



- ELECTROLYTIC AND METABOLIC ABNORMALITIES



# HYPERKALEMIA



- Hyperkalemia is defined as a serum potassium level of  $> 5.2$  mmol/L (high potassium level)

ECG features are :

- Peaked T waves
- P wave widening/flattening, PR prolongation
- QRS widening with bizarre QRS morphology

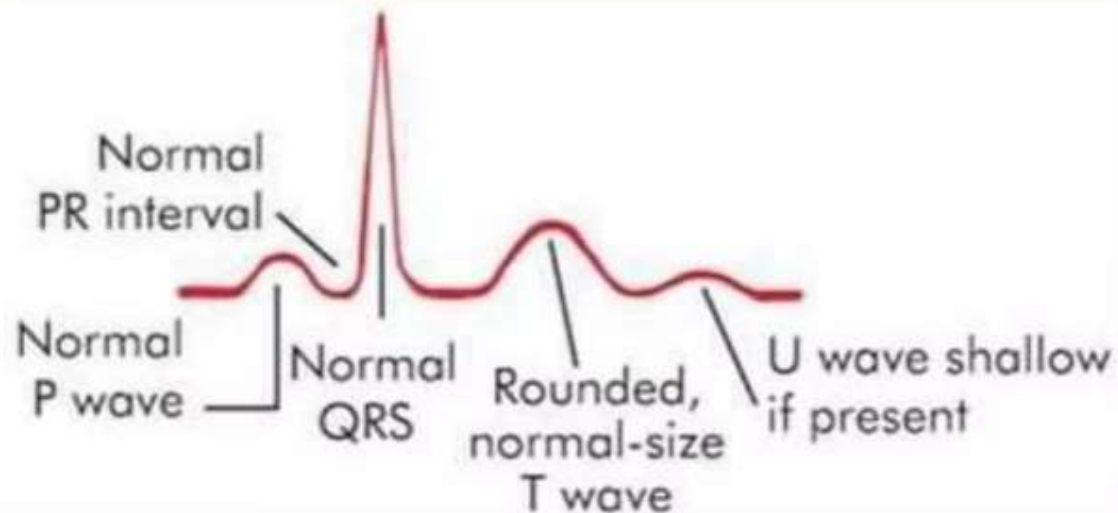


With worsening hyperkalaemia ( $> 9.0$  mmol/L):

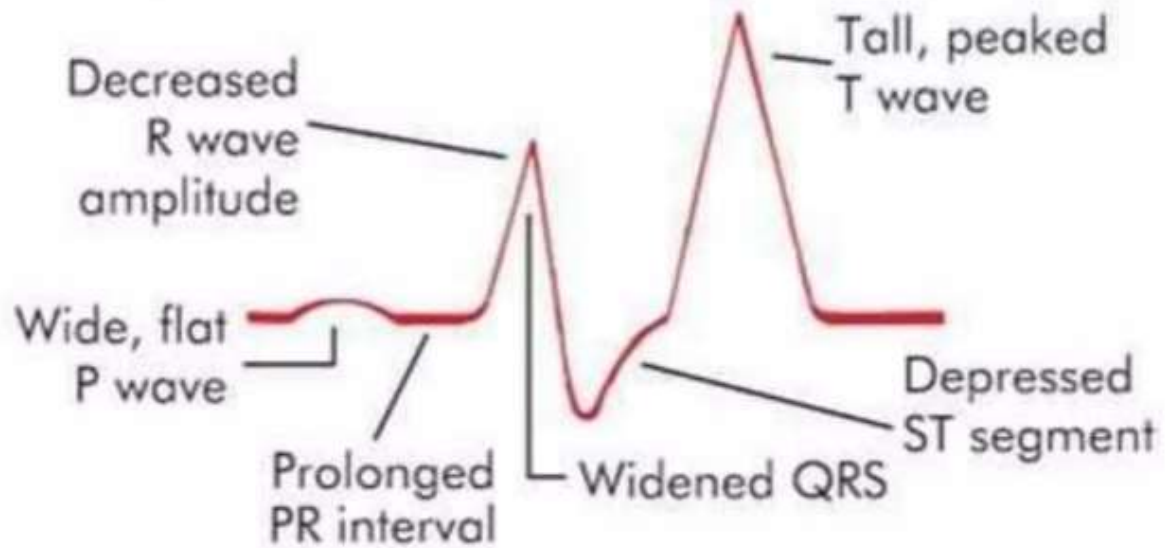
- Development of sine wave appearance (pre-terminal rhythm)
- Ventricular fibrillation
- wide complex rhythm
- Asystole

## ECG Changes with Potassium Imbalance

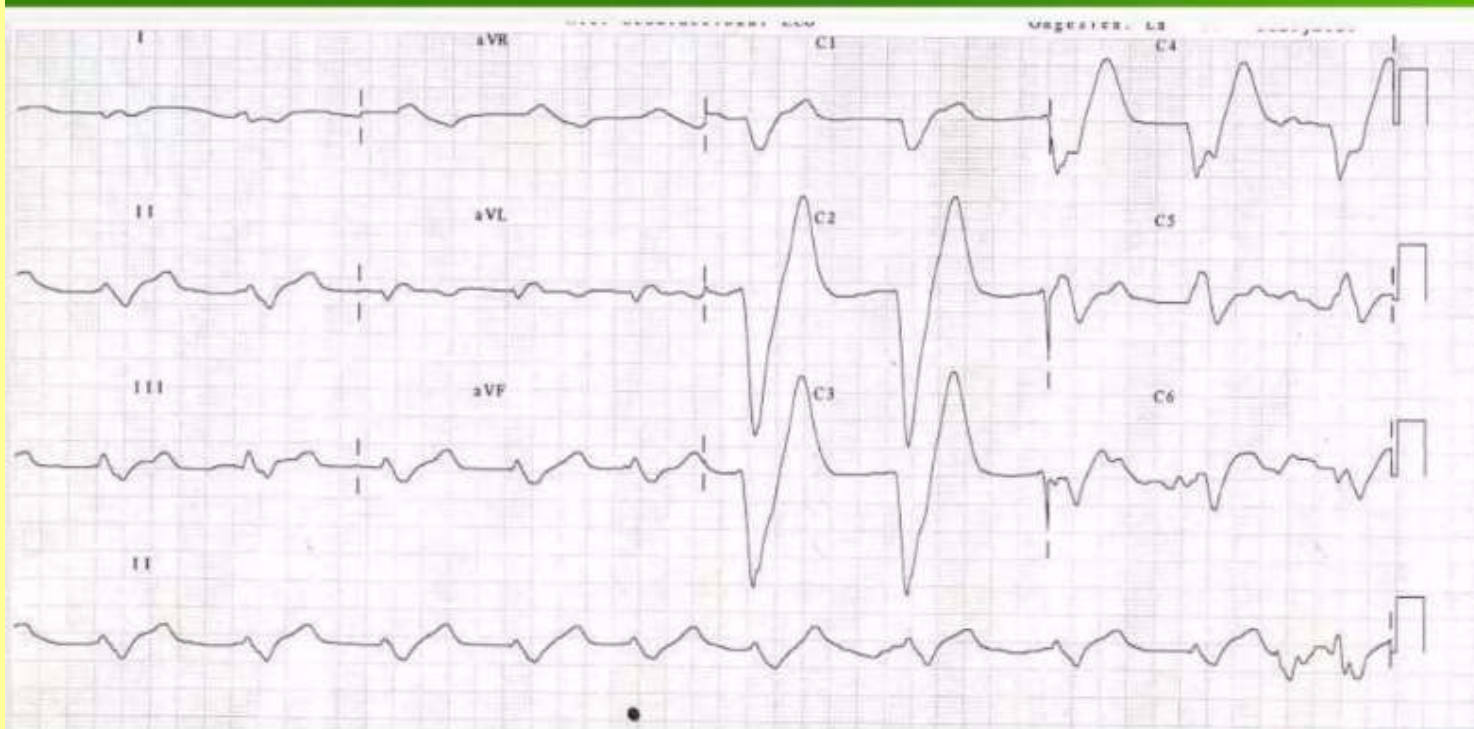
### Normokalemia



## Hyperkalemia



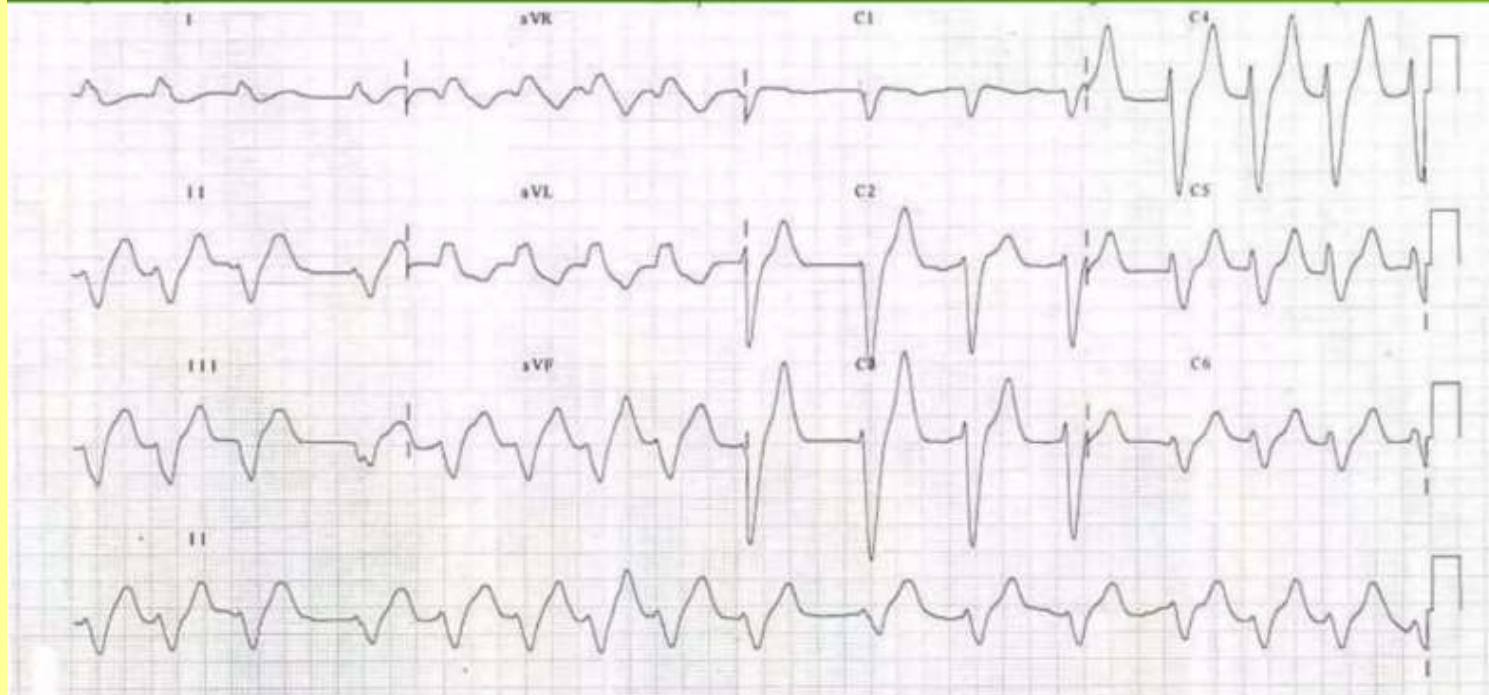
# ECG 1



Courtesy of K.J. Roognards, MD ECG PEDIA.ORG



# ECG 2



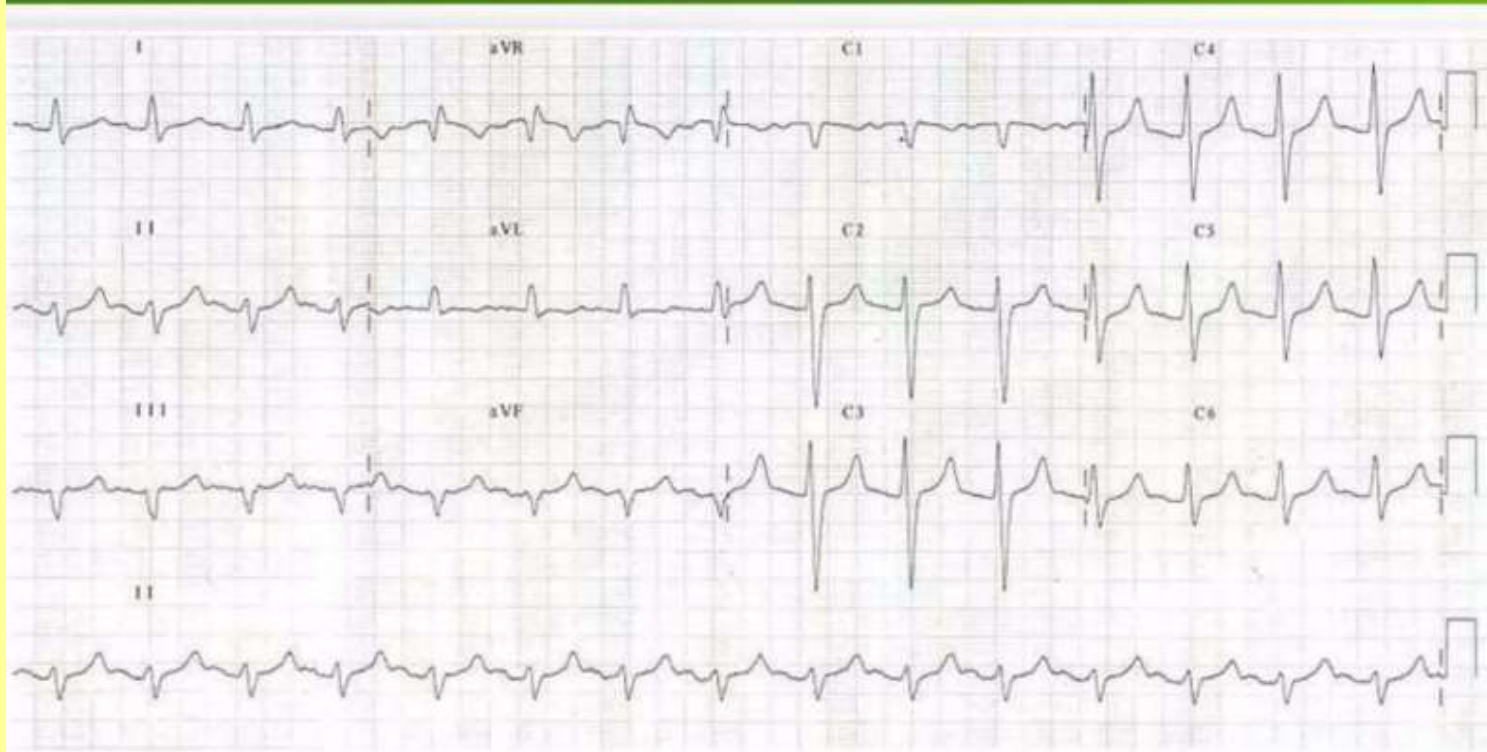
Courtesy of K.J. Hoogwerf, MD [ECG-PEDIA.ORG](http://ECG-PEDIA.ORG)



fppt.com

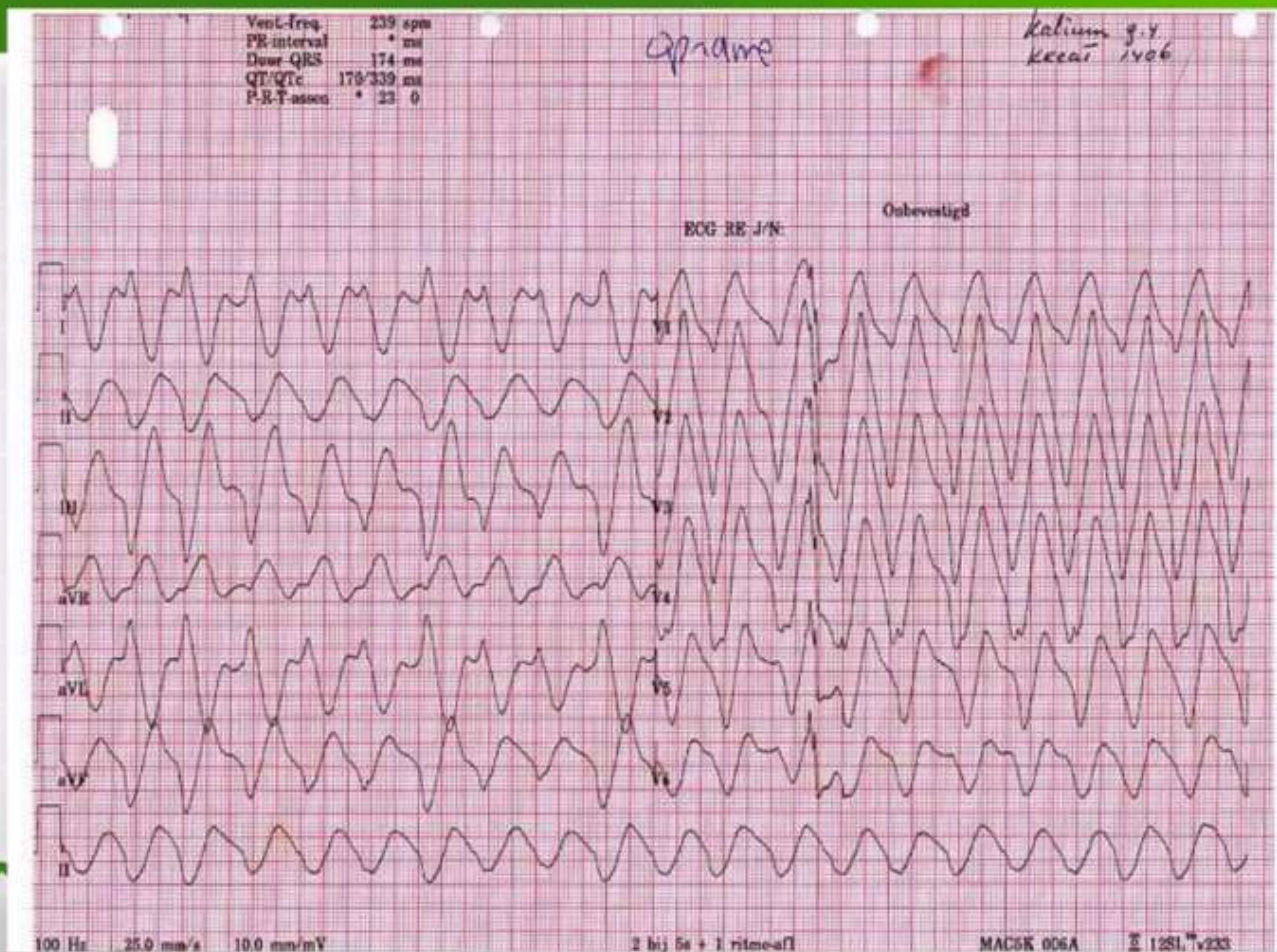


# After Potassium Correction



Courtesy of K.J. Roognards, MD ECG: [PEDIA.ORG](http://PEDIA.ORG)

# Potassium of 9.4 mmol/L





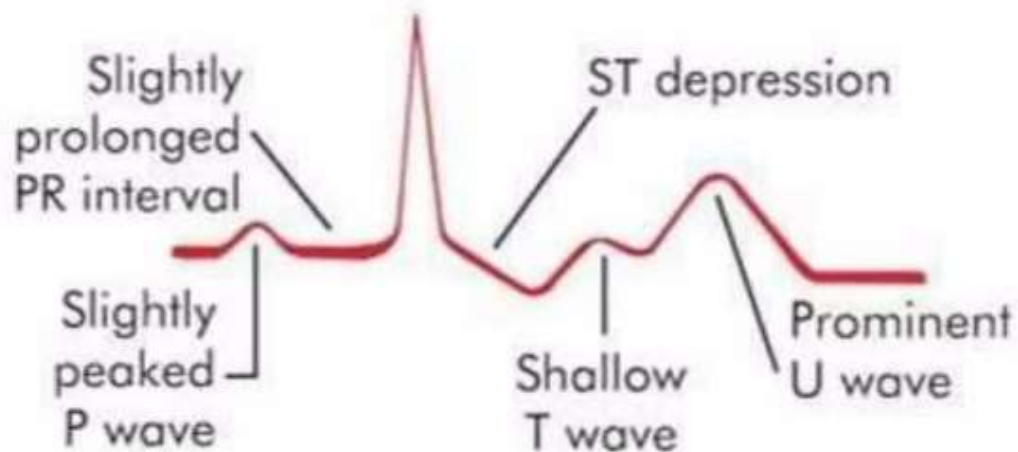
# HYPOKALEMIA



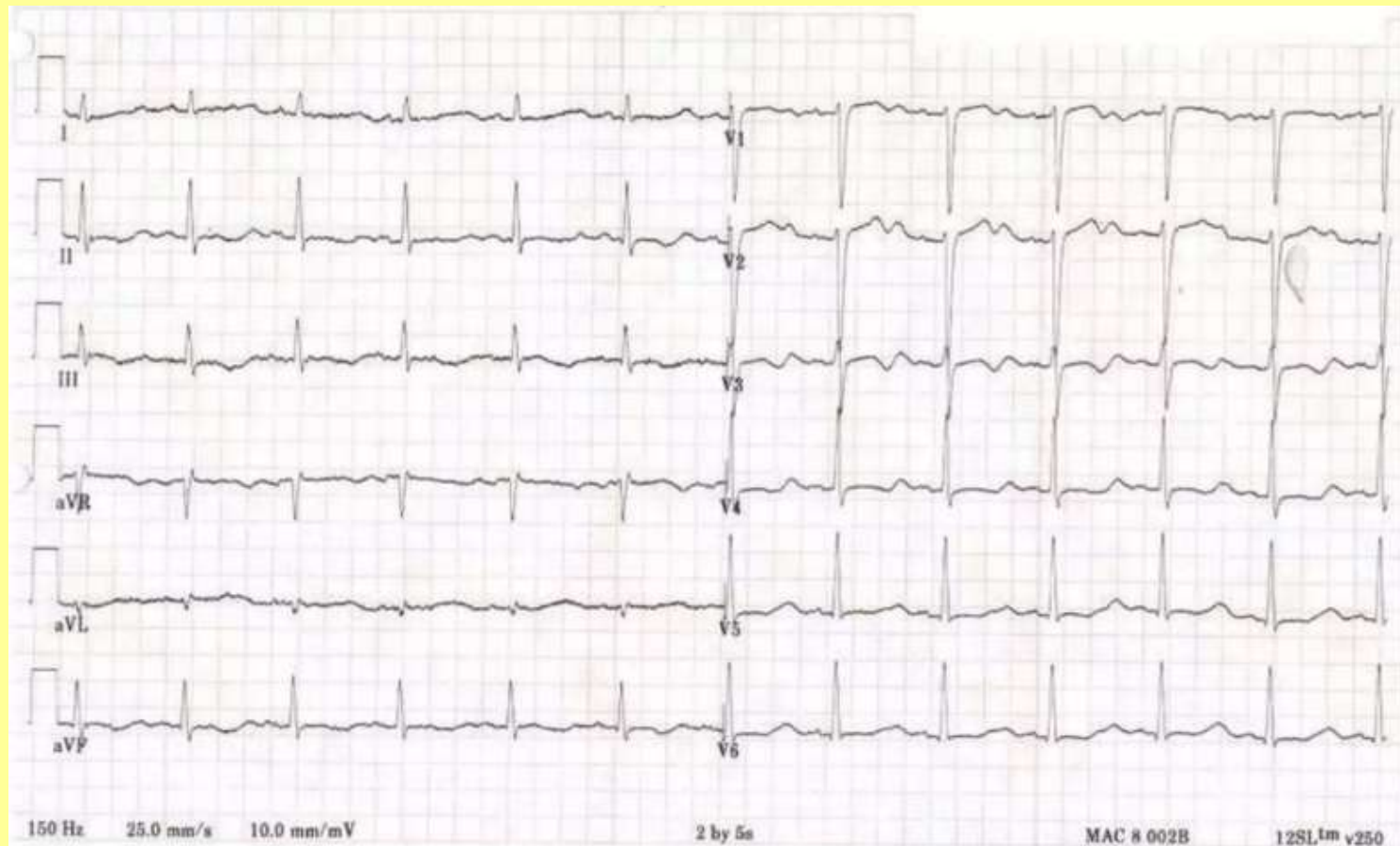
Hypokalemia means low blood potassium levels.

- ✓ ST depression and flattening of T wave
- ✓ negative T wave
- ✓ visible U wave

## Hypokalemia



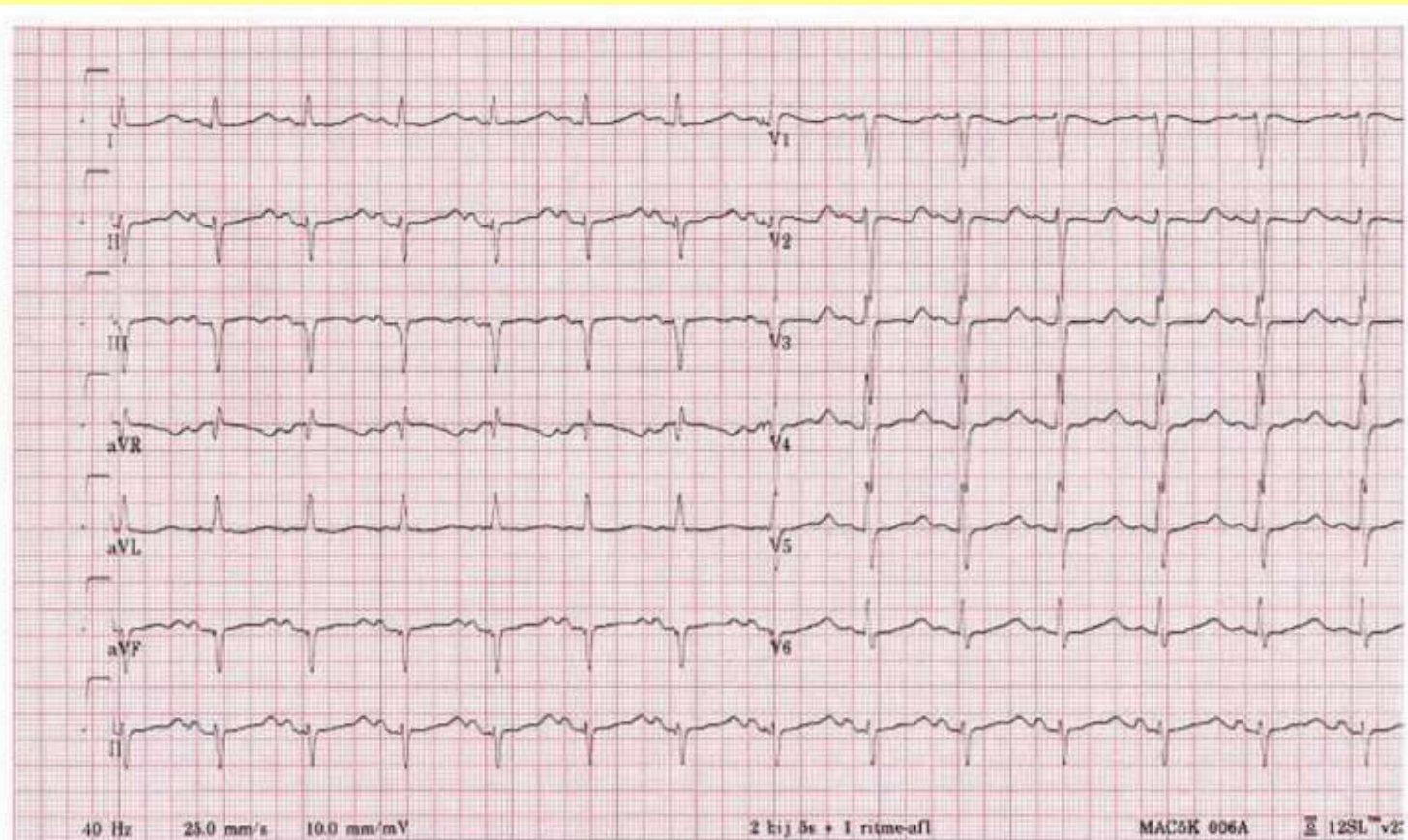




Courtesy of K.J. Roogoods, MD ECG.PEDIA.ORG



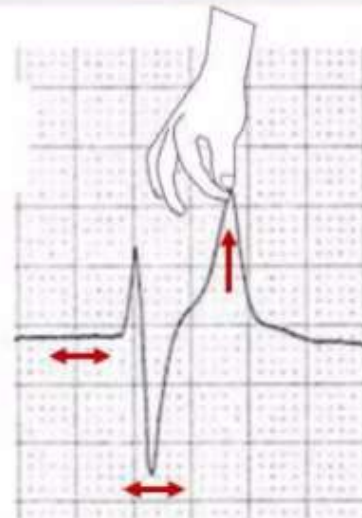
fppt.com





### Hypokalaemia

T wave inversion  
ST depression  
Prominent U wave



### Hyperkalaemia

Peaked T waves  
P wave flattening  
PR prolongation  
Wide QRS complex







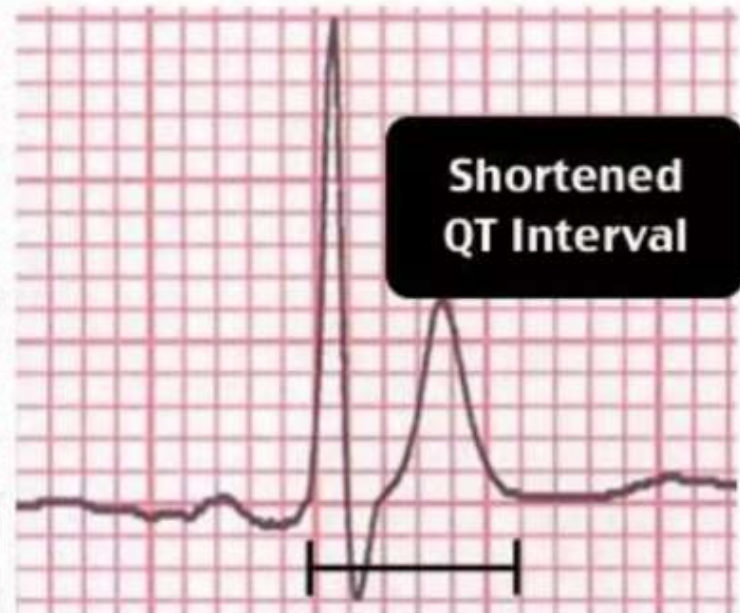
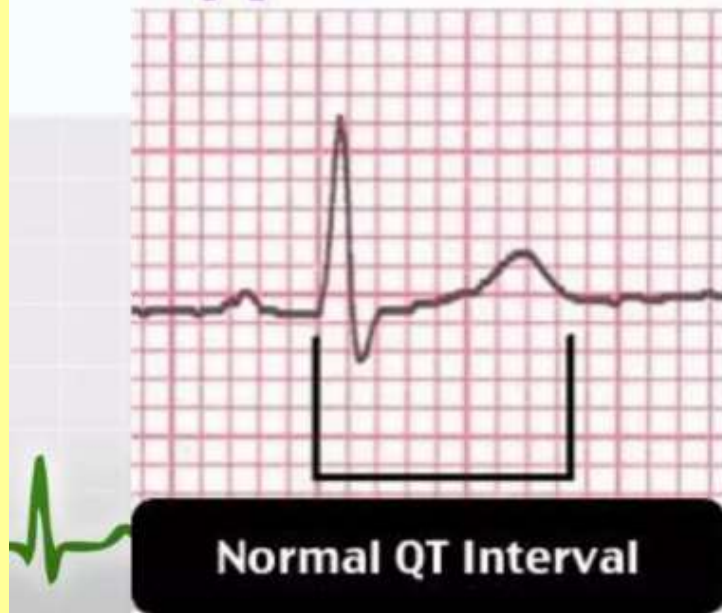
# HYPERCALCEMIA



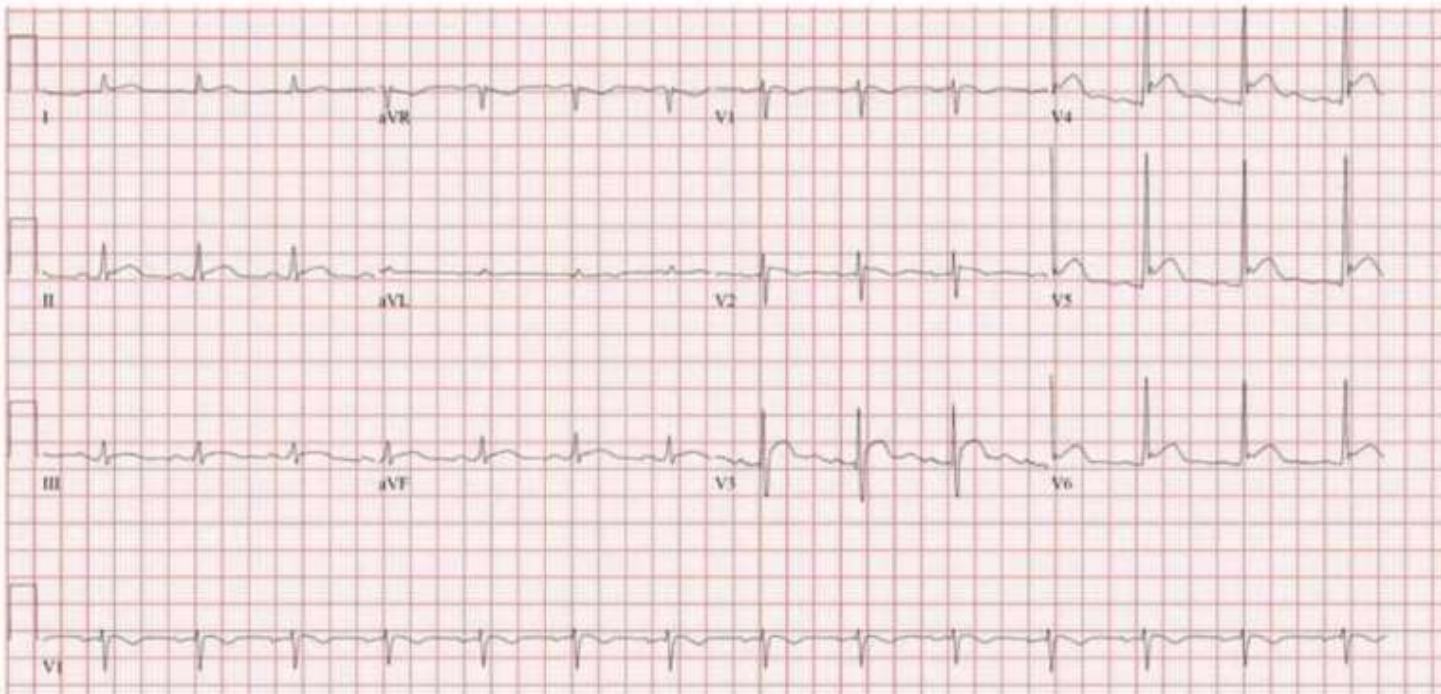
- Normal serum corrected calcium = 2.1 – 2.6 mmol/L
- Mild hypercalcemia = 2.7 – 2.9 mmol/L
- Moderate hypercalcemia = 3.0 – 3.4 mmol/L
- Severe hypercalcemia = greater than 3.4 mmol/L
- Wide QRS , low R wave , disappearance of P wave , tall Peaking T wave.



## Hypercalcemia



# Calcium – 4.6 mmol/L



Courtesy of A. Hirsch, MD, PhD, AMC, The Netherlands

ECG PEDIA.ORG



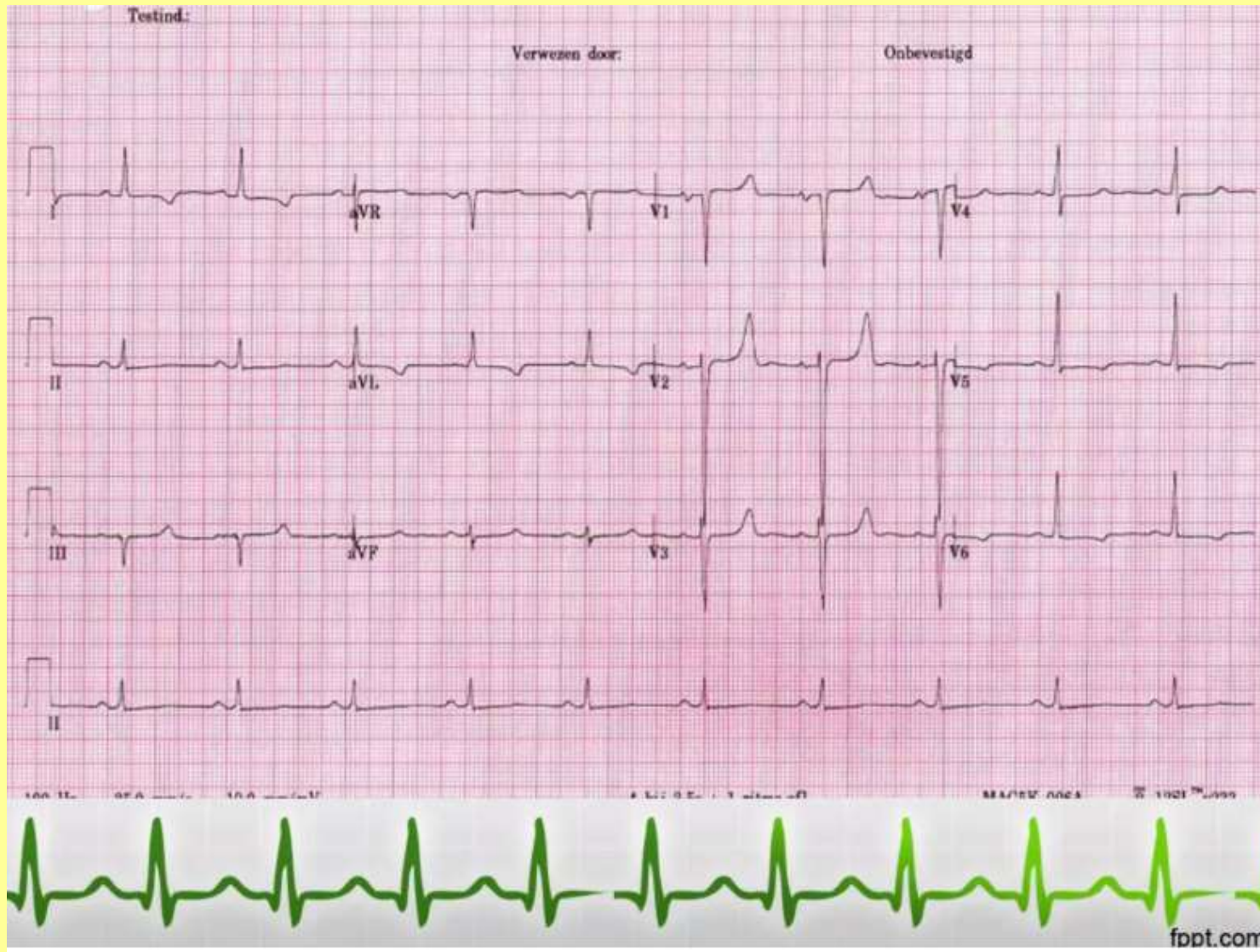


# HYPOCALCEMIA

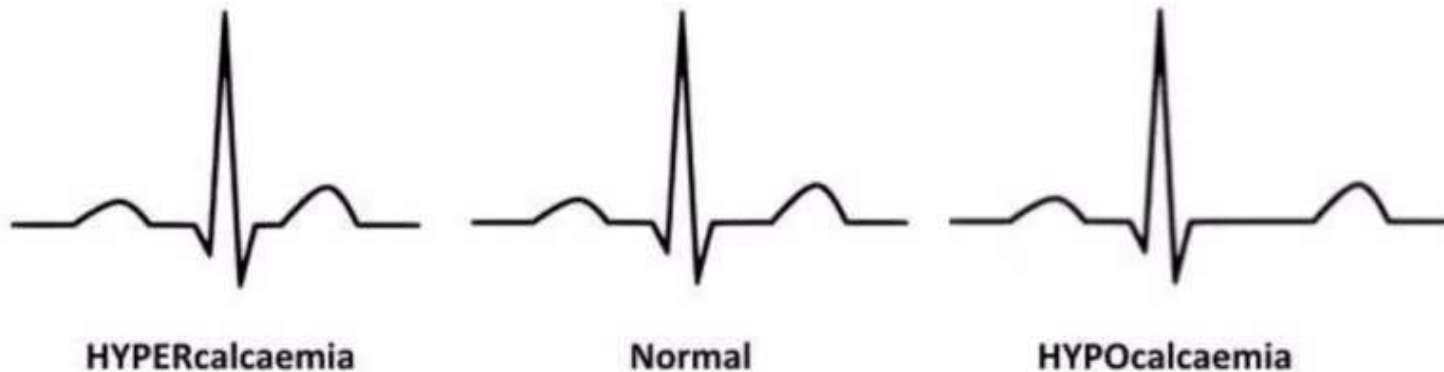


ECG characteristics of hypocalcemia - low blood calcium level

- narrowing of QRS complex
- Reduced PR interval
- Prolongation of QT interval
- Prolonged ST and ST depression
- T wave flattening and inversion
- Prominent U wave



## Hypocalcaemia prolongs the ST segment causing QT prolongation



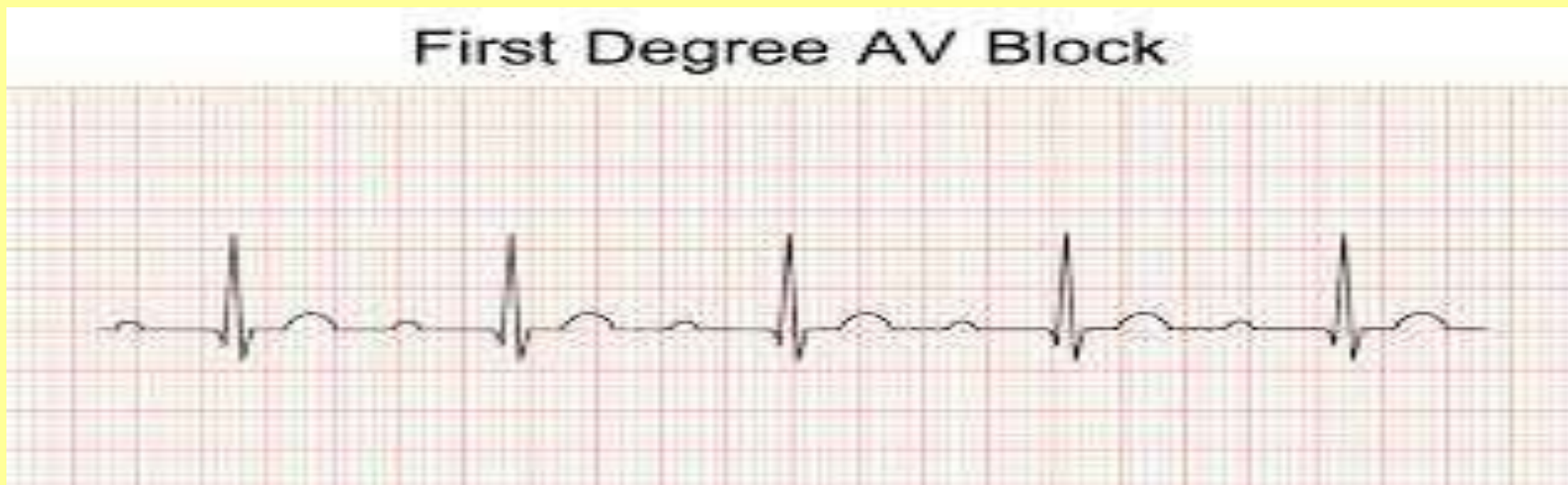


# HYPOMEGNESAEMIA



- Normal range for blood magnesium level is  
**1.7 to 2.2 mg / dL**

First Degree AV Block





# HYPOMEGNESAEMIA

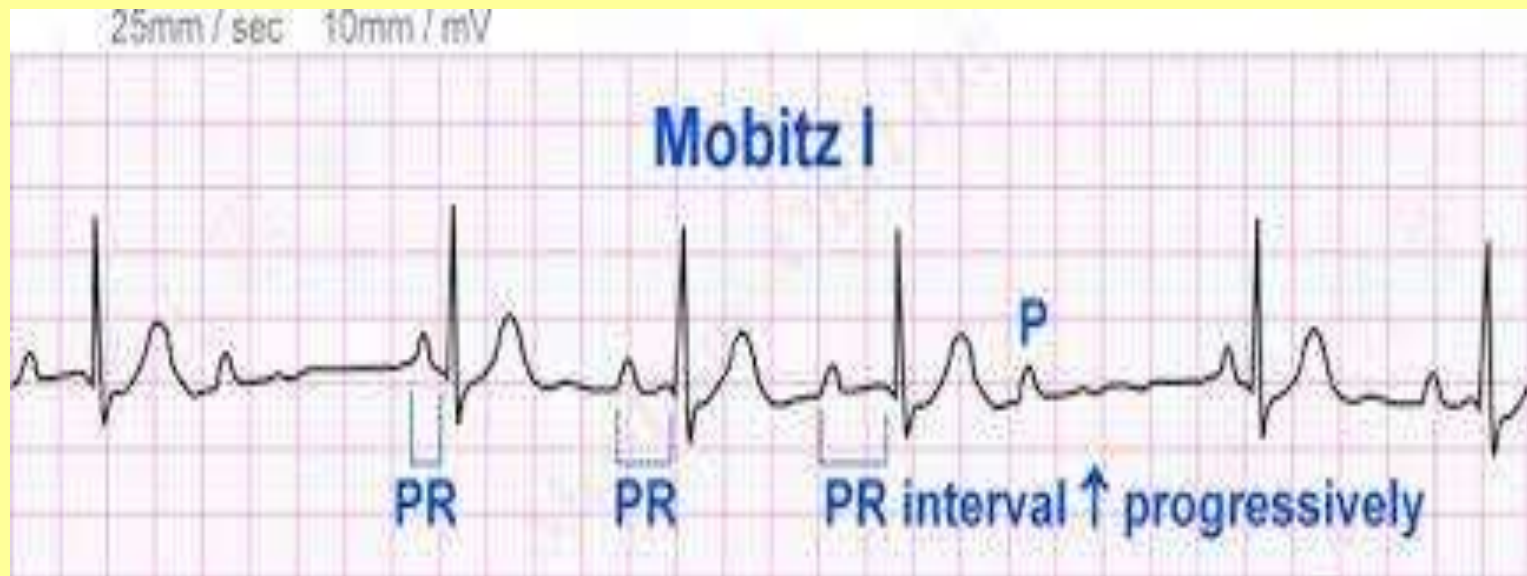


- ECG changes in Isolated - Hypomagnesaemia
  - ✓ prolonged PR interval
  - ✓ prolonged QT interval

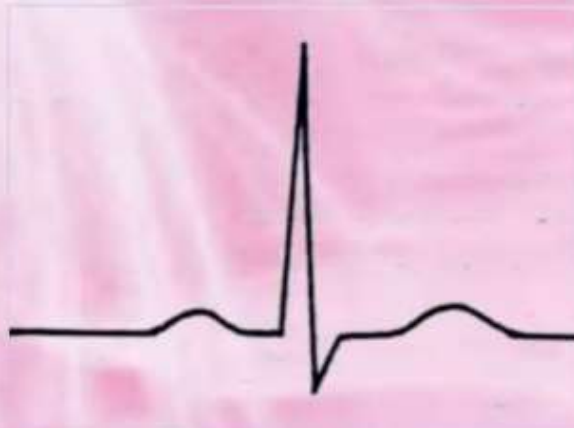




## PROLONGED PR INTERVAL ECG



## ECG Changes: Hypomagnesemia/ Hypermagnesemia



*Serum Mg<sup>++</sup> < 1.5mEq/L*

- *Lengthened QT*
- *Broad & flattened T*
- *often co-exist with hypokalemia*



*Serum Mg<sup>++</sup> > 2.5mEq/L*

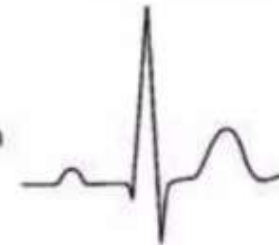
- *Prolonged PR*
- *Lengthened QT*
- *QRS > 0.12sec*



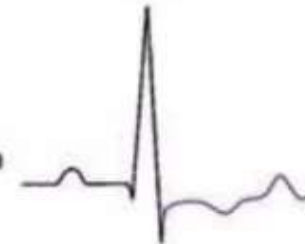
## ECG Changes

- **(K) Hypokalemia:**
  - ST depression
  - Flat/inverted T wave
  - U wave
- **(K) Hyperkalemia:**
  - Flat P wave
  - Prolonged PR interval
  - QRS widening
  - Tall, peaked T wave

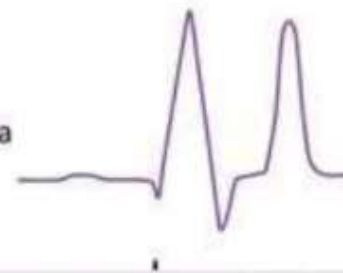
Normal Sinus Rhythm



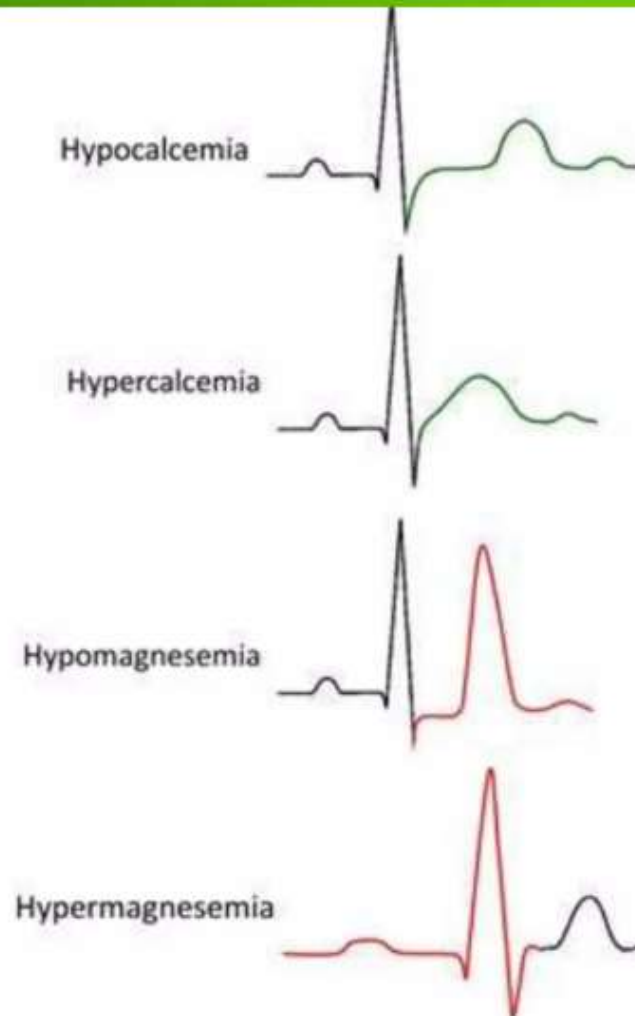
Hypokalemia



Hyperkalemia



- **(Ca) Hypocalcemia**
  - Prolonged ST segment
  - Prolonged QT interval
- **(Ca) Hypercalcemia**
  - Shortened ST segment
  - Widened T wave
- **(Mg) Hypomagnesemia**
  - Tall T wave
  - ST depression
- **(Mg) Hypermagnesemia**
  - Prolonged PR interval
  - QRS widening





THANK YOU