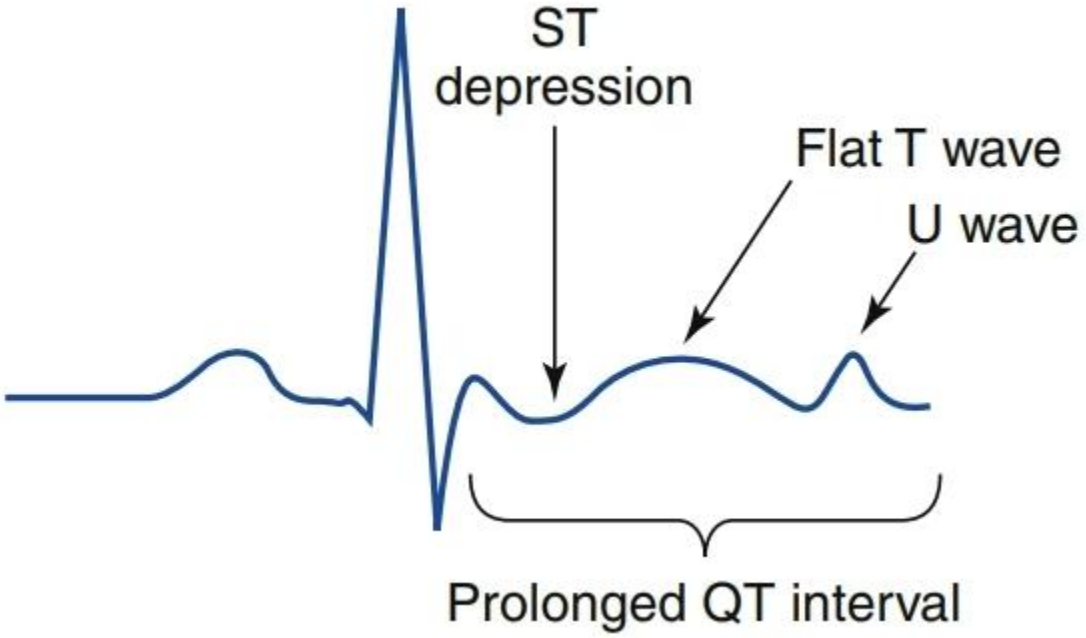
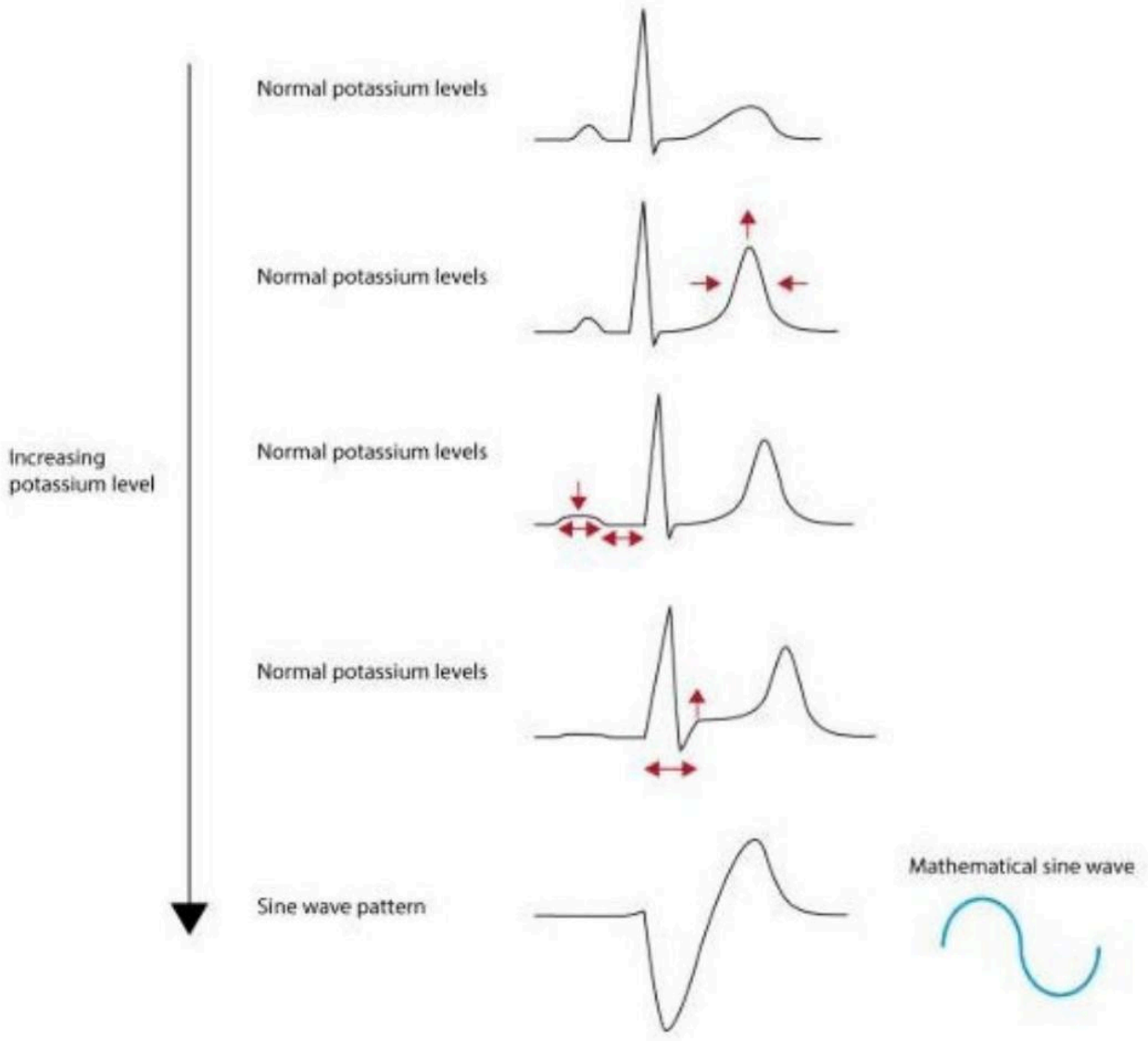
**Hypokalemia**

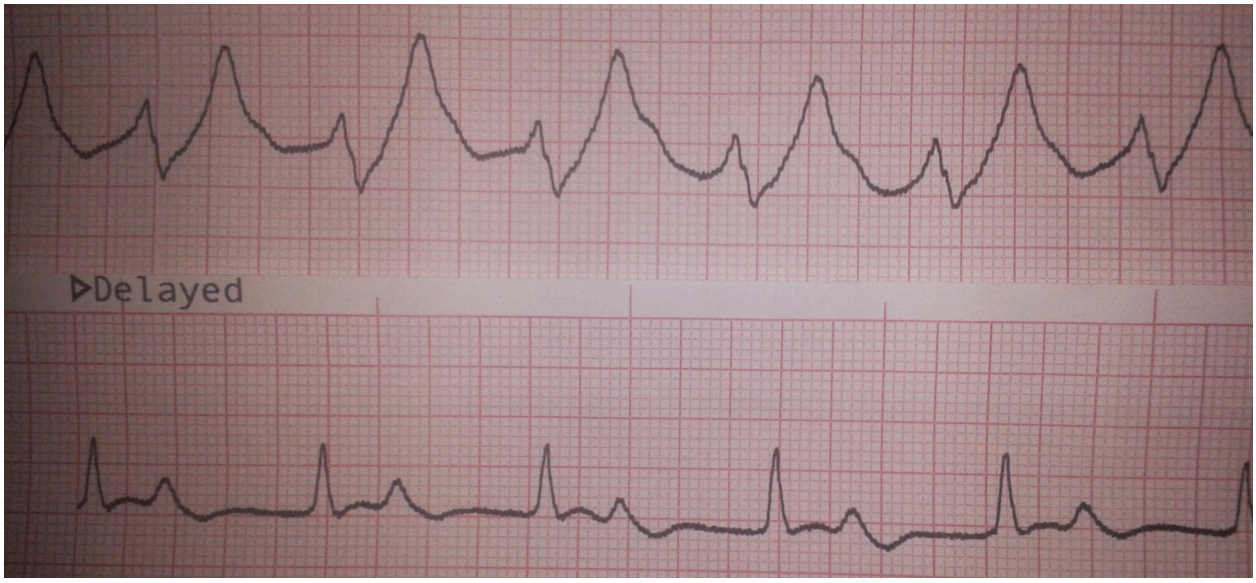
- T wave flattening
- U waves - Best seen in V2,V3, If hypokalemia is severe may become larger than T wave.
- Non specific ST & T wave changes
- Marked QT Prolongation




**Hyperkalemia**

- 6.5 -7.5 : Prolonged PR Interval, tall peaked T waves, short QT interval
- 7.5 - 8.0 : Flattening of the P wave, QRS widening
- 10 - 12 :  QRS complex degradation into a sinusoidal pattern


Normal potassium levels
Normal potassium levels
Normal potassium levels
Normal potassium levels
Increasing potassium level
Sine wave pattern
Mathematical sine wave




ECG of a patient with hyperkalemia showing sine wave pattern (1st Row), ECG after antihyperkalemic measures shows P wave flattening and appearance of QRS back (2nd row).

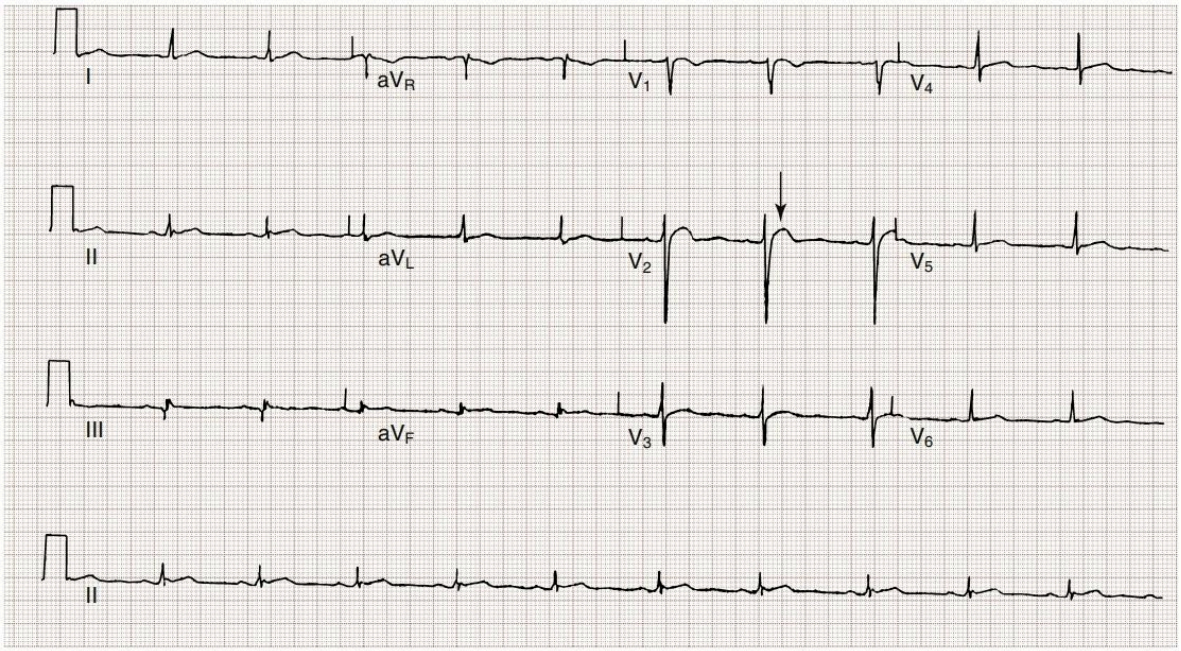
**Hypocalcemia**

- QT prolongation
- Rarely it can produce AV Block, sinus bradycardia, SA block, VF.

**Hypercalcemia**

- Shortened QT Interval
- PR & QRS prolongation
- AV Block and may progress to Complete Heart Block
- Bradycardia

- Osborn like waves, AV Blocks, VT,VF, Tordase pointes may be seen rarely.




Short QT interval *(arrow)* in a patient with multiple myeloma and a calcium level of 14.2 mg/dL. (Courtesy Dr. Barton Campbell.)

**Hypomagnesemia**

- Torsades pointes

Hypermagnesmia

- QRS widening
- QT & PR prolongation

Updated 13/8/2025

Reference


- Rosen's Emergency Medicine. Concept and Clinical Practice. 10th Edition