

Approach to calcium metabolism parameters

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Objectives

- Review basics of laboratory principles
- Review pathophysiology
- Outline Approach to abnormal laboratory findings

Calcium

- Tightly regulated intra- and extracellular concentration
- Intracellular second messenger
- Building block of extracellular matrix

Extracellular Calcium

- Coordinated extracellular deposition important for bone mass and quality

- Ectopic deposition leads to
 - arteriosclerosis
 - valve degeneration
 - joint degeneration
 - nephrolithiasis

Calcium concentration

- Calcium (mmol/l)

- Albumin (g/l)

- Corrected calcium = calcium + 0.02 * (40 - albumin)

Calcium concentration

•Ca 2.02, albumin 30, underlying cirrhosis

•corrected Ca= $2.02+0.02(40-30)=2.22$

•Ca 2.68, albumin 46, mild dehydration

•corrected Ca= $2.68+0.02(40-46)=2.56$

Calcium metabolism parameters

- Ca, albumin, corrected Ca
- PTH, parathyroid hormone
- Phosphate
- Magnesium
- 25-OH vitamin D
- PTHrp PTH related peptide

Parathyroid hormone (PTH)

- Produced only by parathyroid glands
- Inversely related to corrected calcium concentration
- Controls rate of calcium reabsorption from urine, exchange of calcium in bone, and absorption

.Cor Ca 2.3

PTH 35

Parathyroid hormone: Normal 5-50

.Cor Ca 2.2

PTH 45

.Cor Ca 2.1

PTH 10

.Cor Ca 2.34

PTH 75

.Cor Ca 2.15

PTH 185

.Cor Ca 2.85

PTH 105

.Cor Ca 3.45

PTH 295

.Cor Ca 4.5

PTH 800

.Cor Ca 1.81

PTH 35

Approach to hypercalcemia

- Corrected calcium above upper range of normal
- PTH dependent vs PTH independent
- PTH is inversely related to calcium
- Paraneoplastic (PTHrp, Myeloma, Osteolytic process)
- Immobilization
- Excess absorption
- Excess reabsorption
- Drugs
- Familial

Approach to hypocalcemia

Corrected calcium below lower range of normal

- Inadequate absorption
- Hypoparathyroidism (low PTH)
- Low Vitamin D
- Hyperphosphatemia

Approach to low vitamin D

(normal 75-250)

- Endemic in temperate climate zone
- Inadequate sun exposure
- Inadequate absorption
- Different threshold for different physiologic effects
- SUPPLEMENT to low half of normal range
- 1000 IU should increase the level by ~25
- Avoid hypercalcemia, hypercalciuria

PTRrp (normal <2)

- Hypercalcemia, hypophosphatemia
- Paraneoplastic when present in excess
 - - solid tumors
 - - lymphoma
- Measure when PTH inappropriately suppressed for the degree of (hyper)calcemia

Hyperparathyroidism

- Primary
- Secondary (CRI, low vitamin D)
- Tertiary (ESRD, Renal transplant)

Primary Hyperparathyroidism

- Uniglandular / 4-gland hyperplasia
- Spontaneous/Familial

Primary Hyperparathyroidism

Indications for surgical treatment:

- 1. Hypercalcemia >2.8
- 2. Osteoporosis
- 3. Nephrolithiasis

Primary Hyperparathyroidism

Localization prior to surgical treatment:

- 1. SestaMIBI/ Tc scan
- 2. Ultrasound
- 3. CT scan

Summary

- Calcium level interpretation requires measurement of corrected calcium, as well as renal function, phosphate, and PTH, and sometimes vitamin D level
- Avoid laboratory issues
- Surgical tx of Primary HPT when indicated

Questions

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