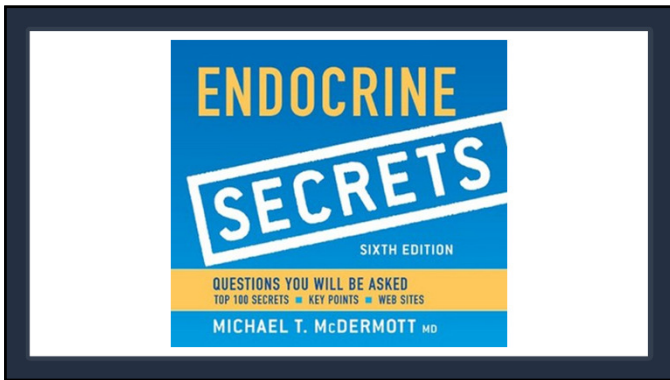


1

Learning Objectives

- Understand the severity of various endocrine emergencies
- Appreciate the important questions regarding abnormal lab values
- Select the appropriate treatment for life threatening endocrinopathies
- Recognize when to escalate cares or to contact endocrinology

2



3



4

43-year-old healthy female

- 4:45 Friday Afternoon
- BMP Results
 - Sodium: 139
 - Potassium: 4.3
 - Chloride: nobody cares
 - Glucose: 119
 - Creatinine: 1.1
 - Calcium: 13.2 (normal up to 10.5)

5

ENDOCRINE DIFFICULTY RATING


EASY INTERMEDIATE ADVANCED EXPERT ONLY

SKI Trip Guide


6

Corrected Calcium Levels


< 11.5	11.5 – 12.5	12.6 – 14	>14
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EASY



INTERMEDIATE



ADVANCED

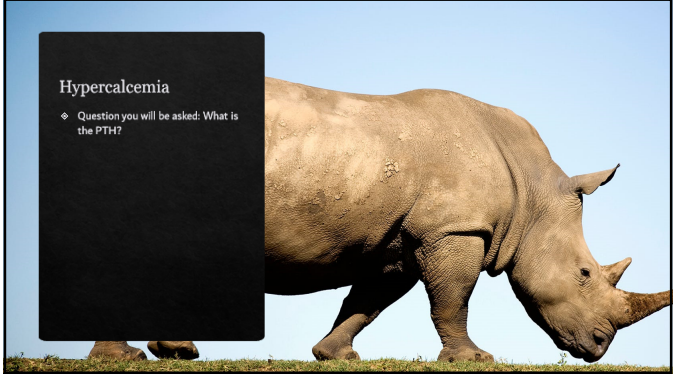


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7

Hypercalcemia

Question you will be asked: What is the PTH?



8

Hypercalcemia

- Mostly primary hyperparathyroidism outpatient (70%) and sometimes inpatient (20%)
- Cancer causes half (50%) of inpatient hypercalcemia
- Hyperparathyroidism and cancer cause 90% of all elevated calcium levels

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Hypercalcemia due to parathyroid adenoma

The most likely diagnosis in this patient:

Other differentials of Hypercalcemia include:

- Vitamin D or A excess
- Immobilization
- Thyrotoxicosis
- Addison's disease/Acidosis
- Milk-alkali syndrome
- Inflammatory disorders
- Neoplastic disease
- Thiazide diuretic
- Rhabdomyolysis
- AIDS
- Paget's disease/Parenteral nutrition
- Sarcoidosis

"VITAMIN TRAPS"

Super Useless Mnemonic

10

Hypercalcemia Symptoms

	Mild (corrected calcium 10.5-11.9 mg/dL)	Moderate (corrected calcium 12.0-13.9 mg/dL)	Severe (corrected calcium > 14.0 mg/dL)
Neuropsychiatric	Anxiety, depression	Cognitive dysfunction	Lethargy, confusion, stupor, coma
Gastrointestinal	Anorexia, nausea, constipation	Anorexia, nausea, constipation	Pancreatitis
Renal	Polyuria	Dehydration	Renal insufficiency, dehydration
Cardiac	Shortened QT interval	Shortened QT interval	Arrhythmia, ventricular tachycardia
Musculoskeletal	None	Weakness	Weakness

Note: Information from Inzucchi (2004); Ahmed & Hashiba (1988); Kiewiet, Ponsen, Janssens, & Fels (2004).

Bones Stones Moans Groans

11

MANAGEMENT OF HYPERCALCEMIA

Treatment

- IV Fluids
- Sometimes Bisphosphonates
 - Pamidronate
 - Zoledronic Acid
- REALLY Bad
 - Denosumab
 - Emergent parathyroid surgery
 - Dialysis

```

    graph TD
      Root[HYPERCALCEMIA MANAGEMENT] --> Mild[MILD HYPERCALCEMIA  
S.CALCIUM 10-12]
      Root --> Moderate[MODERATE HYPERCALCEMIA  
S.CALCIUM 12-14 mg/dL]
      Root --> Severe[SEVERE HYPERCALCEMIA  
S.CALCIUM >14 mg/dL]

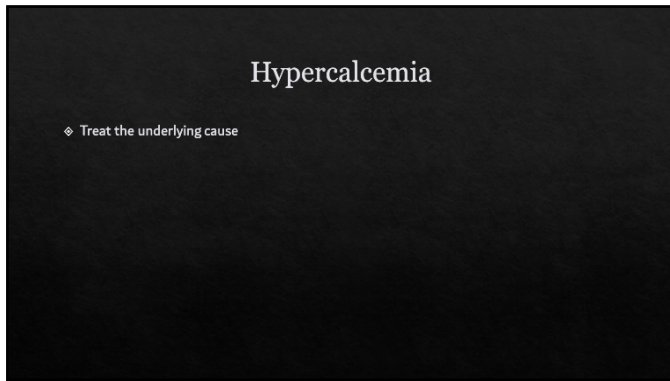
      Mild --> MildAsym[Usually asymptomatic]
      Mild --> MildSym[Symptomatic]
      MildAsym --> MildNoMed[No medical management]
      MildSym --> MildNoMed
      MildSym --> MildIV[Intravenous normal saline @300cc/hour]
      MildSym --> MildBis[Bisphosphonates*  
Alendronate  
Pamidronate]

      Moderate --> ModAsym[Asymptomatic]
      Moderate --> ModSym[Symptomatic]
      ModAsym --> ModNoMed[No medical management]
      ModSym --> ModIV[Intravenous normal saline @300cc/hour]
      ModSym --> ModBis[Bisphosphonates**]

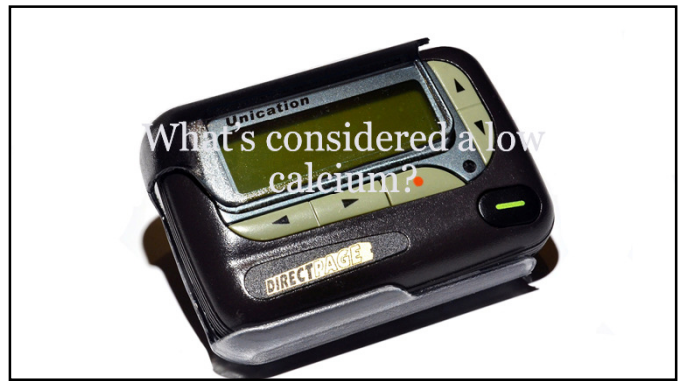
      Severe --> SevereIV[Intravenous normal saline]
      Severe --> SevereCalc[Calcitonin**]
      Severe --> SevereDen[Denosumab]
      Severe --> SevereFuro[Furosemide***]
      Severe --> SevereBis[Bisphosphonates]

      MildNoMed --> Recur[Recurrent hypercalcemia/very severe hypercalcemia >18mg/dL]
      ModNoMed --> Recur
      SevereBis --> Recur
      Recur --> RecurBis[Bisphosphonates]
      Recur --> RecurDen[Denosumab]
      Recur --> RecurSurg[Emergent parathyroid surgery]
      Recur --> RecurDial[Dialysis]
      
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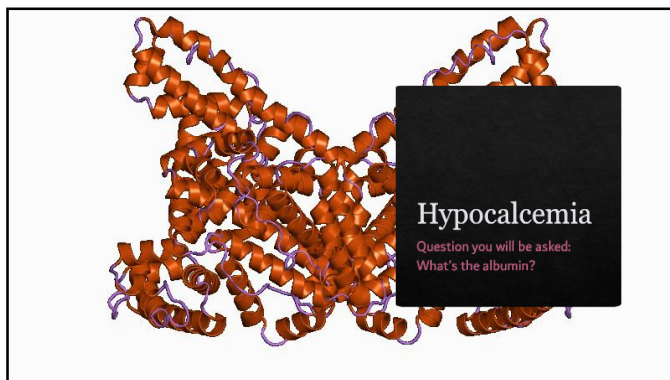
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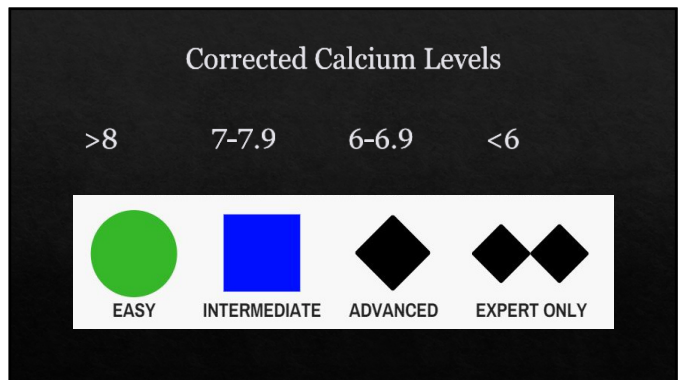
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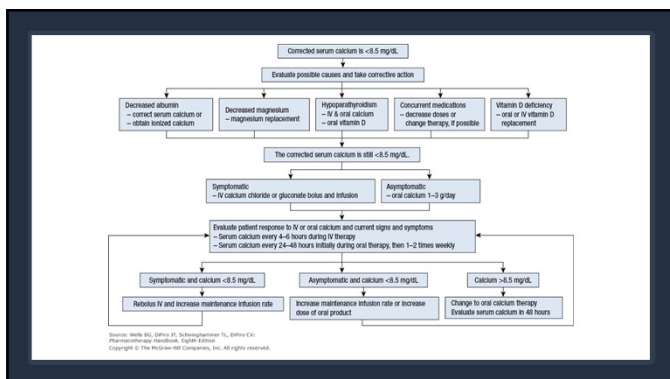
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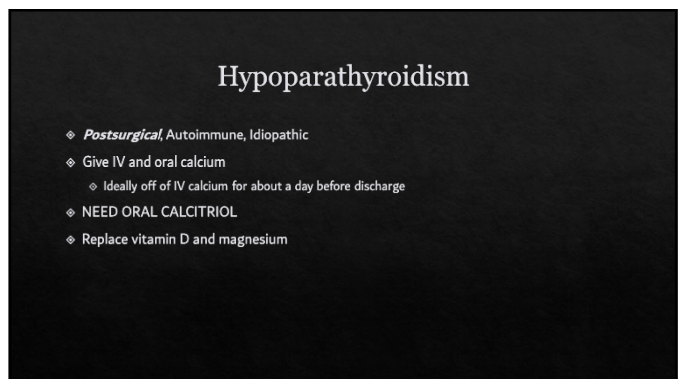
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16



17



18




Carbonate vs Citrate

- Carbonate less expensive
 - Take with meals
- Citrate absorbed better
- Carbonate 40% elemental
 - Less pills
- Citrate 21% elemental



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Umm, elemental calcium?



20

Elemental Calcium

Product	Strength per Tablet (mg)	Milligrams of Elemental Calcium	Tablets per 1000 mg
Calcium Carbonate Preparations	800	240	...
Alka-Mag	1000	300	...
Caltrate	1000	300	...
Caltrate + D	1000	300	...
Cherwell Calcium	1200	360	...
Vitamin D	1000	300	...
Vitamin D + D	1000	300	...
Vitamin D + D3	1000	300	...
Vitamin D + D3 + K2	1000	300	...
Vitamin D + D3 + K2 + M	1000	300	...
Vitamin D + D3 + K2 + M + Z	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T + U	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T + U + V	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T + U + V + W	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T + U + V + W + X	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T + U + V + W + X + Y	1000	300	...
Vitamin D + D3 + K2 + M + Z + B6 + C + E + K + L + N + P + Q + R + S + T + U + V + W + X + Y + Z	1000	300	...

Formulation, dose	Elemental calcium dose	Number of tablets that provide elemental calcium 0.5 g/day	Number of tablets that provide elemental calcium 1.0 g/day
Calcium acetate	Philo 667 mg 168 mg	3	12
Calcium carbonate	Calci-Mag powder 1250 mg 500 mg	3	4
Calcium carbonate (generic)	400 mg 80 mg	10	13
500 mg 200 mg	5	10	
600 mg 240 mg	7	9	
650 mg 260 mg	6	8	
700 mg 280 mg	5	7	
800 mg 320 mg	4	5	
1000 mg 400 mg	3	4	
1200 mg 480 mg	3	4	
1500 mg 600 mg	3	4	
2000 mg 800 mg	3	4	
2500 mg 1000 mg	3	4	
3000 mg 1200 mg	3	4	
3500 mg 1400 mg	3	4	
4000 mg 1600 mg	3	4	
4500 mg 1800 mg	3	4	
5000 mg 2000 mg	3	4	
5500 mg 2200 mg	3	4	
6000 mg 2400 mg	3	4	
6500 mg 2600 mg	3	4	
7000 mg 2800 mg	3	4	
7500 mg 3000 mg	3	4	
8000 mg 3200 mg	3	4	
8500 mg 3400 mg	3	4	
9000 mg 3600 mg	3	4	
9500 mg 3800 mg	3	4	
10000 mg 4000 mg	3	4	

21

Just tell me what to do

- 0.5 mcg calcitriol twice daily
- 2-3 TUMS three times a day
- 50,000 units ergocalciferol weekly





22



So my patient was fatigued ...

23

Low Cortisol

- Question you will be asked: Have they received steroids?
 - Oral
 - Injections
 - Topical
 - Inhaled
 - Eye drops

24

Have they received steroids over the last few days?

Yes



No



25



Adrenal Insufficiency

Adrenal Fatigue is not real

26


Adrenal Crisis

- ◆ Give steroids now
- ◆ Hydrocortisone
- ◆ Prednisone
- ◆ Dexamethasone
- ◆ Figure out the rest later
- ◆ Real adrenal insufficiency gets better in hours


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Adrenal Replacement

Glucocorticoid	Approximate Equivalent Dose (mg)	Relative Anti-Inflammatory (Glucocorticoid) Potency			Biological Half-Life (Hours)
		Hydrocortisone	Methylprednisolone	Dexamethasone	
Short-Acting					
Cortisone	25	0.8	0.8	8 - 12	
Hydrocortisone	20	1.0	1.0	8 - 12	
Intermediate-Acting					
Methylprednisolone	4	5	0.5	18 - 36	
Prednisolone	5	4	0.8	18 - 36	
Prednisone	5	4	0.8	18 - 36	
Long-Acting					
Dexamethasone	0.75	25	0.0	36 - 54	


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Dr. Newman there is a provider that wants to talk you about their patient with *thyroid storm*

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55 year old female

- ◆ "Hi Dr. Newman this is Karen with One Call and Dr. Potluri would like to transfer a patient for thyroid storm."
- ◆ "Ah yeah this is Dr. Potluri, this patient isn't doing so hot, they have thyroid storm, we are going to need your assistance."
- ◆ "So they came in for a fall, but they were getting crazy in the ER and they were found to have a fib. They also have COPD and maybe heart failure. A TSH was checked and it was pretty low."
- ◆ "Um, let me check, oh yeah, TSH under 0.01, and oh man, temp is 104, and yeah, now that you mention it, they are pretty gorked out..."

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Thyroid Storm

Question you will be asked: How soon can you get them to Fargo?

32

Thyroid Storm




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Thyroid Storm

- ◆ 20% Mortality
- ◆ Needs immediate cares, even before some labs return
- ◆ Call endocrine even if you don't have an endocrinologist on staff



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Thyroid Storm

- ◆ Bad thyroid disease AND a superimposed precipitating event
 - ◆ Surgery, infection, trauma
- ◆ TSH completely suppressed (<0.01)
- ◆ Free T3 and T4 substantially elevated
- ◆ Don't wait for tests to return to start treatment
- ◆ Labs can be misleading → same in hyperthyroidism
- ◆ Differential: Sepsis, pheochromocytoma, malignant hyperthermia

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Thyroid Storm

TABLE 2
Burch-Wartofsky Point Scale

Temperature (°F)		Cardiovascular dysfunction	
99-99.9	5 points	Tachycardia (beats/min)	
100-100.9	10	99-109	5
101-101.9	15	110-119	10
102-102.9	20	120-129	15
103-103.9	25	130-139	20
≥ 104.0	30	≥ 140	25
Central nervous system effects		Atrial fibrillation	10
Absent	0	Heart failure	
Mild (agitation)	10	Mild (pedal edema)	5
Moderate (delirium)	20	Moderate (bibasilar rales)	10
Severe (seizure, coma)	30	Severe (pulmonary edema)	15
Gastrointestinal-hepatic dysfunction		Precipitant history	
Moderate (diarrhea, nausea/vomiting, abdominal pain)	10	Positive	0
Severe (unexplained jaundice)	20	Negative	10

Total: < 25, storm unlikely; 25 - 45, impending storm; > 45, thyroid storm

Source: Burch, Wartofsky. Endocrinol Metab Clin North Am. 1993.²

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Thyroid Storm Treatment

- ◊ PTU or methimazole → Decrease hormone synthesis
- ◊ SSKI or Lugol's solution → Inhibit thyroid hormone release
- ◊ Beta Blocker → reduce the heart rate
- ◊ Dexamethasone/Hydrocortisone and IV fluids → Support Circulation
- ◊ Fix the underlying cause

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Thyroid Storm Pearls

- ◊ Call for help ASAP: ICU, endocrine, pharmacy, cardiology
- ◊ Just about any beta blocker will work
- ◊ The OR sometimes has SSKI or Lugol's solution
- ◊ Don't forget about sepsis

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39

High TSH

Question you will be asked:
Just tell me what the TSH is

40


High TSH Levels

<20	20.1 - 50	50.1 - 100	>100
			
EASY	INTERMEDIATE	ADVANCED	EXPERT ONLY

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Myxedema coma

- ◊ Really bad hypothyroidism (TSH over 100)
- ◊ Older patients or patients without thyroids
 - ◊ Thyroidectomy scar
- ◊ Precipitating event
 - ◊ Infection, trauma, MI, CHF, PE, stroke, GI bleed, CNS suppressing drugs, prolonged cold exposure
- ◊ Mortality 0% to 45%
 - ◊ Anecdotal experience closer to 0%



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Myxedema Coma Treatment

- ◊ Stress steroids first → hydrocortisone 100 mg every 8 hours
- ◊ LT4, LT3, or both
- ◊ Combination therapy generally accepted → 200 to 300 mcg IV LT4, 20 to 50 mcg LT3 IV, 100 mcg LT4 oral with 25 mcg LT3 orally
- ◊ Long term cares

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Myxedema Coma Pearls

- ◊ Give steroids first
- ◊ Check if they have pituitary disease (Both TSH and FT4 will be undetectable)

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Review

- ◊ Hypercalcemia → IV Fluids
- ◊ Hypocalcemia → IV calcium, oral calcitriol and lots of oral calcium
- ◊ Adrenal Crisis → IV steroids followed by oral steroids
- ◊ Thyroid Storm → Transfer, call endocrine
- ◊ Myxedema Coma → IV thyroid hormone followed by oral thyroid hormone

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