The information contained in this protocol should never be used as a substitute for clinical judgment.

The clinician and the patient need to develop an individual treatment plan that is tailored to the specific needs and circumstances of the patient.
Vitamin D/Calcium/Magnesium Protocol

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VITAMIN D/CALCIUM/MAGNESIUM PROTOCOL

IN PATIENTS WITH AN ABNORMAL DXA SCAN, NON-TRAUMATIC FRACTURE OR LOW SERUM CALCIUM
MEASURE 25 HYDROXYVITAMIN D LEVEL AND iPTH LEVEL (Draw 8am to 10am)

25-Hydroxyvitamin D < 20
- iPTH > 65 if GFR ≥ 60
- iPTH > 70 if GFR 30-59
- iPTH > 110 if GFR 15-29
- iPTH > 300 if GFR < 15 or dialysis
- Refer to Page 2

25-Hydroxyvitamin D ≥ 20 and < 30
- iPTH ≤ 65 if GFR ≥ 60
- iPTH ≤ 70 if GFR 30-59
- iPTH ≤ 110 if GFR 15-29
- iPTH < 300 if GFR < 15 or dialysis
- Refer to Page 3

25-Hydroxyvitamin D ≥ 30
- Refer to Page 4

Refer to Page 5
25 Hydroxyvitamin D Level < 20

- iPTH > 65 if GFR > 60
- iPTH > 70 if GFR 30-59
- iPTH > 110 if GFR 15-29
- iPTH > 300 if GFR < 15 or dialysis

**Elevated Serum Calcium**
- Refer to Endocrinologist to evaluate for Primary Hyperparathyroidism

**Normal Serum Calcium or Normal serum corrected calcium (cCA)**

**Low Serum Calcium and low cCA**

- *Elemental Calcium 500 mg/BID daily
- Vitamin D 50,000 IU weekly x 8 weeks then continue monthly

- In 12 weeks, Remeasure:
  - Serum Calcium
  - Serum cCA if clinically indicated
  - 25-Hydroxyvitamin D
  - iPTH (Draw 8am to 10am)

Refer to Page 7

*Consider using calcium citrate if the patient has a history of kidney stones and patient’s creatinine clearance is >60, otherwise use Calcium carbonate.

If patient has a history of kidney stones measure urinary calcium/creatinine ratio before and 12 wks after starting calcium supplementation.
25 Hydroxyvitamin D Level < 20

- iPTH ≤ 65 if GFR ≥ 60
- iPTH ≤ 70 if GFR 30-59
- iPTH < 110 if GFR 15-29
- iPTH < 300 if GFR < 15 or dialysis

Elevated Serum Calcium

First measurements of serum Calcium, 25 Hydroxyvitamin D and iPTH levels?

- No
  - Reevaluate Patient
  - Remeasure Serum Calcium, 25 Hydroxyvitamin D and intact PTH levels
  - Refer to Page 1

Normal Serum Calcium or normal serum corrected calcium (cCA)

Vitamin D 50,000 IU weekly x 8 weeks

In 12 weeks, Remeasure:
- Serum Calcium
- Serum cCA if clinically indicated
- 25-Hydroxyvitamin D
- iPTH (Draw 8am to 10am)

Refer to Page 1

Low Serum Calcium And cCA

*Elemental Calcium 500 mg/BID daily

Refer to Magnesium Tolerance Test Page 11

*Consider using calcium citrate if the patient has a history of kidney stones and patient’s creatinine clearance is >60, otherwise use calcium carbonate.

If patient has a history of kidney stones measure urinary calcium/creatinine ratio before and 12 wks after starting calcium supplementation.
25 Hydroxyvitamin D Level ≥ 20 AND < 30

- iPTH > 65 if GFR ≥ 60
- iPTH > 70 if GFR 30-59
- iPTH > 110 if GFR 15-29
- iPTH > 300 if GFR < 15 or dialysis

**Elevated serum Calcium**
- Refer to Endocrinologist to evaluate for Primary Hyperparathyroidism

**Normal Serum Calcium**
- Or normal serum corrected calcium (cCA)

**Low Serum Calcium and low cCA**
- *Elemental Calcium 500 mg/TID daily

- Vitamin D 50,000 IU weekly x 4 weeks

In 12 weeks, Remeasure:
- Serum Calcium
- Serum cCA if clinically indicated
- 25-Hydroxyvitamin D
- iPTH (Draw 8am to 10am)
- 8am Spot urine for NTx

**Repeat Serum Calcium**
- Normal Serum Calcium
- High Serum Calcium

- Vitamin D 50,000 IU Weekly x 2 weeks

- Refer to Endocrinologist to evaluate for Primary Hyperparathyroidism
- Stop Calcium, Multivitamin and Vitamin D

**Normal Serum Calcium**

**High Serum Calcium**

- Refer to Endocrinologist to evaluate for Primary Hyperparathyroidism

*Consider using calcium citrate if the patient has a history of kidney stones and patient’s creatinine clearance is >60, otherwise use Calcium carbonate.

If patient has a history of kidney stones measure urinary calcium/creatinine ratio before and 12 wks after starting calcium supplementation.
25-Hydroxyvitamin D Level ≥ 20 AND < 30

- iPTH ≤ 65 if GFR ≥ 60
- iPTH ≤ 70 if GFR 30-59
- iPTH ≤ 110 if GFR 15-29
- iPTH < 300 if GFR < 15 or dialysis

Elevated serum Calcium

- First measurements of serum Calcium, 25 Hydroxyvitamin D and iPTH levels?

  - Yes
  - Reevaluate patient
  - Remeasure Serum Calcium, 25 Hydroxyvitamin D and iPTH levels

  - No

Normal Serum Calcium or normal serum corrected calcium (cCA)

- *Elemental Calcium 500 mg/BID daily

Low Serum Calcium and low cCA

- *Elemental Calcium 500 mg/TID daily

Vitamin D 50,000 IU weekly x 4 weeks

In 12 weeks, Remeasure:
- Serum Calcium
- Serum cCA of clinically indicated
- 25-Hydroxyvitamin D
- iPTH (Draw 8am to 10am)
- 8 am Spot urine for NTx

Refer to Magnesium Tolerance Test Page 11

*Consider using calcium citrate if the patient has a history of kidney stones and patient’s creatinine clearance is >60, otherwise use calcium carbonate.

If patient has a history of kidney stones measure urinary calcium/creatinine ratio before and 12 wks after starting calcium supplementation.
25 Hydroxyvitamin D Level ≥ 30

Is calculated GFR is > 60?

Yes

See Chronic Kidney Disease (CKD) protocol

No

Low Serum Calcium, low eCA, and High iPTH Level

Elevated Serum Calcium and low iPTH Level

Normal or elevated Serum Calcium and High iPTH Level

Normal serum calcium

*Elemental Calcium 500 mg BID with food PLUS Vitamin D 50,000 units twice a month (suggest 1st & 15th each month)

Low or normal serum calcium and Low iPTH

Elevated Serum Calcium and Low iPTH level

25 hydroxyvitamin D level yearly

First measurements of serum calcium, 25 Hydroxyvitamin D and iPTH levels?

No

Reevaluate patient

Measure PTH-like peptide

Evaluate for metastatic cancer

Measure urinary Calcium/Creatinine ratio

Re-evaluate patient

Yes

Consider granulomalous disease, lymphoma, or TB

Refer to Endocrinologist to evaluate for Primary Hyperparathyroidism

Low or normal serum calcium and Low iPTH

Remeasure serum Calcium, 25 Hydroxyvitamin D and iPTH levels

If patient has a history of kidney stones measure urinary calcium/creatinine ratio before and 12 wks after starting calcium supplementation.
25 Hydroxyvitamin D Level Remeasured after treatment with high dose Vitamin D

- **25-Hydroxyvitamin D < 20**
  - Refer to Malabsorption workup Page 13
  - Urine dipstick for protein
    - Negative for protein
      - No further work up
    - Positive for protein
      - 24 hour urine for protein and creatinine
        - >4 grams of protein in 24 hr urine
          - Refer to Nephrologist for evaluation of nephrotic syndrome
        - Refer to Malabsorption Workup Page 13

- **25-Hydroxyvitamin D > 20 < 30**
  - Vitamin D 50,000 IU weekly x 4 weeks
    - Remeasure 25-Hydroxyvitamin D Level
      - 25-Hydroxyvitamin D < 30
        - Refer to Malabsorption workup Page 13
      - 25-Hydroxyvitamin D > 30
        - Measure Vitamin D-binding protein

- **25-Hydroxyvitamin D ≥ 30**
  - Refer to page 6
1,25-Dihydroxyvitamin D Level

Low

1,25-Dihydroxyvitamin D (Rocaltrol) 0.25 mcg po BID x 8 weeks

Re-measure 1,25-Dihydroxyvitamin D Level

1,25-Dihydroxyvitamin D Level low

1,25-Dihydroxyvitamin D (Rocaltrol) 0.25 mcg po BID x 4 weeks

Malabsorption work up
Refer to Page 13

1,25-Dihydroxyvitamin D Level low

1,25-Dihydroxyvitamin D Level normal

Measure PTH Level (Draw 8am to 10am)

iPTH level within normal limits

Serum Calcium and cCA within normal limits

No further work up

Refer to Page 9

Low Serum Calcium and low cCA if measured

Low serum calcium and low cCA if measured

Refer to Endocrinologist

1,25-Dihydroxyvitamin D Level normal

Measure serum Calcium and cCA if clinically indicated

Normal or elevated serum calcium or cCA or normal or elevated cCA

Elevated iPTH Level

Re-measure 1,25-Dihydroxyvitamin D Level

1,25-Dihydroxyvitamin D Level normal

1,25-Dihydroxyvitamin D Level high

Stop Rocaltrol

Physician to re-evaluate patient

Malabsorption work up
Refer to Page 13

Refer to Page 9
Measure urinary Calcium/Creatinine Ratio

- < 0.2 mg for women
  - < 0.25 mg for men
  - Make sure patient taking total of 1500 mg of elemental Calcium a day
  - In 3 months remeasure urinary Calcium/Creatinine Ratio

- > 0.2 mg to 0.25 mg for women
  - ≥ 0.25 mg to 0.3 mg for men
  - Magnesium Tolerance Test (Valid only if patient has normal renal function - calculated GFR ≥ 60) Refer to Page 11
  
  - Magnesium Retention > 25%
  
  - Magnesium Deficiency
    - Treat with Magnesium Oxide
    - Refer to Page 11
  
  - Magnesium Retention ≤ 25%
  
  - Magnesium Deficiency
    - Treat for Idiopathic Hypercalciuria

- > 0.25 mg for women
  - > 0.3 mg for men
  - Refer to Magnesium Tolerance Test - Page 10
  
  - Magnesium Retention > 25%
  
  - Magnesium Deficiency
    - Treat with Magnesium Oxide
    - Refer to Page 11
  
  - Magnesium Retention ≤ 25%
  
  - Re-evaluate Patient
MAGNESIUM TOLERANCE TEST
Valid only if patient has normal renal function
(calculated GFR ≥ 60)

Collect 24-hour urine for magnesium and creatinine. (Computer code MAGUPR)

Once the initial 24 hour urine collection is completed, infuse 0.2 mEq (2.4mg) elemental magnesium per Kg lean body weight in 50ml 5% dextrose over a 4 hour period.

At the start of the magnesium infusion, begin another 24 hour urine collection for magnesium and creatinine (Computer Code MAGUPO)

Patient Sticker

RESULTS OF MAGNESIUM TOLERANCE TEST

- Magnesium Retention <25%
  - No evidence magnesium deficiency
    - Re-evaluate Patient
- Magnesium Retention >25%
  - Magnesium Deficiency
    - Treat with Magnesium oxide
      See Page 11

NORTHEAST MEDICAL CENTER
STANDING ORDERS
DR. KELLING
MAGNESIUM TOLERANCE TEST
Treatment with Magnesium Oxide

Creatinine Clearance > 30

Magneesium Oxide 400mg BID

Patient intolerant of dose

No

Measure serum magnesium level 1 and 3 weeks after beginning Magnesium Oxide

Low Serum Magnesium

Increase Magnesium Oxide by 400mg a day

Measure Serum Magnesium level 1 and 3 weeks after increasing the dose of Magnesium Oxide

Patient intolerant of dose

No

Re-evaluate patient

Yes

Normal Serum Magnesium

Continue same dose magnesium oxide

Repeat serum magnesium level as clinically indicated

Re-evaluate patient

Yes

High Serum Magnesium

Stop Magnesium Oxide and re-evaluate patient

No

Decrease dose to Magnesium Oxide 400mg

Patient intolerant of dose

Yes

Re-evaluate patient

Low Serum Magnesium

Re-evaluate patient

Normal Serum Magnesium

Continue same dose magnesium oxide

High Serum Magnesium

Stop Magnesium Oxide and re-evaluate patient

Repeat serum magnesium level as clinically indicated
Malabsorption Workup

Measure:
- D-xylose test
- Serum IgA level
- IgA antitissue transglutaminase antibody
- Osteocalcin (if not already measured)

Antibodies positive and D-xylose test abnormal
- Refer to GI for further evaluation for sprue

Antibodies negative and D-xylose test abnormal
- Refer to GI for further evaluation of causes of mucosal malabsorption other than sprue

Antibodies negative and D-xylose test normal
- Refer to GI to evaluate for pancreatitis insufficiency