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 tailored to the specific needs and circumstances of the patient.
**Chronic Kidney Disease Protocol**

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Screening for Chronic Kidney Disease (CKD)

Measure serum creatinine to estimate GFR (eGFR) in all patients who are at risk for CKD including diabetes, hypertension, autoimmune diseases (such as systemic lupus erythematosus), recurrent UTI’s, recurrent kidney stones, family history of CKD, older age (>60), ethnic minorities, (such as African American, American Indians, Hispanic or Latino, Asian or Pacific Islanders), history of acute renal failure, daily NSAID use, evidence of kidney damage, such as albuminuria (A/C ratio ≥ 17 (men) and ≥ 25 (women) except for diabetes A/C ratio ≥ 30 with regard for gender), hematuria, pyuria with casts and without active UTI, renal tubular acidism, nephrogenic diabetes insipidus, etc.

- eGFR ≥ 90
  - Refer to Page 2

- eGFR 60-89
  - Refer to Page 3

- eGFR < 60
  - Refer to Page 5
Calculate eGFR yearly

Refer to Page 1

CKD risk reduction (diabetes, hypertension, etc.)

Treat underlying renal disease if present
Page 3

**eGFR 60-89**

Repeat eGFR in 3 months

- **eGFR ≥ 90**
  - Repeat eGFR in 3 months
  - Refer to Page 2

- **eGFR 60-89**
  - Refer to Page 4

- **eGFR < 60**
  - Repeat eGFR in 3 months
  - Refer to Page 5
eGFR 60-89

- CKD risk reduction (diabetes, hypertension, etc.)
- Estimated GFR yearly
- Treat underlying renal disease if present

- eGFR ≥ 90
  - Refer to Page 2

- eGFR 60-89

- eGFR < 60
  - Repeat eGFR in 3 months

- eGFR ≥ 90
  - Repeat eGFR in 1-2 weeks
- eGFR 60-89
- eGFR < 60
  - Refer to Page 5

- eGFR 60-89
  - Refer to Page 2
  - Refer to Page 5
GFR < 60

Obtain:
- Blood pressure
- Fasting lipid panel
- Fasting blood sugar \( \times 2 \) if clinically indicated
- 2 hr. glucose tolerance test per protocol if clinically indicated
- Hemoglobin (Hgb)
- Hematocrit (Hct)
- Serum phosphorus

Evaluate for:
- Reduced functioning and well being

Evaluate for neuropathy

Eliminate nephrotoxic drugs such as NSAIDS

Obtain:
- Serum calcium
- 8am serum intact PTH (iPTH)
- Serum electrolytes
- Serum albumin
- A/C ratio in urine
- Urinalysis (U/A)
- U/S of kidneys
- Consider SPEP/UPEP if clinically indicated

Obtain:
- Blood pressure
- Serum calcium
- 8am serum intact PTH (iPTH)
- Serum electrolytes
- Serum albumin
- A/C ratio in urine
- Urinalysis (U/A)
- U/S of kidneys
- Consider SPEP/UPEP if clinically indicated

Repeat:
- Hgb/Hct yearly

Refer to Page 7

Hypertension Present

Diabetes Present

Hgb <12 for males and postmenopausal females or Hgb <11 for premenopausal females

Phosphorus

Calcium

iPTH

Electrolytes

Albumin

A/C ratio

U/A

Ultrasound of Kidneys

LDL ≥ 100
And/or
Triglycerides ≥ 150

Refer to Hypertension Protocol

Refer to Diabetes Protocol

Refer to Peripheral Neuropathy Pathway

Correct as clinically indicated

Repeat as indicated

Nutritional Evaluation
**U/A and ultrasound of kidneys**

- **U/A**
  - >5 RBC
    - Refer for urology evaluation
    - Evaluation unremarkable
    - Consider nephrology evaluation
  - RBC Casts
    - Refer for nephrology evaluation
  - >5 WBC
    - Urine culture
      - Culture positive
        - Treat UTI
        - Repeat U/A after treatment completed
        - >5 WBC
          - Reculture urine
          - Refer for urology evaluation
      - Culture negative
        - Recheck urinalysis, BMP and refer for urology evaluation
        - Evaluation unremarkable
        - Recheck urinalysis, if persists needs nephrology evaluation

- **Ultrasound of kidneys**
  - No significant abnormalities
    - No further evaluation
  - Significant abnormalities
    - Evaluate as clinically indicated
Hgb <12 for males and postmenopausal females or Hgb <11 for premenopausal females

**Microcytic Anemia**

**Obtain:**
- 8 AM Serum Iron
- 8 AM Total Iron Binding Capacity
- 8 AM Percent Transferrin Saturation (TSAT)
- 8 AM Serum Ferritin
- Stools x3 for occult blood

**Normochromic/Normocytic Anemia**

**Obtain:**
- B12 Level
- RBC Folate
- SPEP
- UPEP
- 8 AM Serum Iron
- 8 AM Total Iron Binding Capacity
- 8 AM Percent Transferrin Saturation (TSAT)
- 8 AM Serum Ferritin
- Stools x3 for occult blood
- Reticulocyte count
- Haptoglobin

*If not done in the last 2 months*

**Macrocytic Anemia**

**Obtain:**
- B12 Level
- RBC Folate
- Reticulocyte count

---

- **B12 level Low**
  - RBC Folate low
    - Treat with folic acid
  - SPEP or UPEP show M-spike
    - Refer to Hematology/Oncology
- **Ferritin ≥ 100 and percent transferrin saturation ≥ 20%**
  - Workup other causes anemia See Protocol
- **Ferritin <100 and percent transferrin saturation <20%**
  - Refer to Page 8
- **Stool Positive for blood**
  - Refer to GI
- **Elevated reticulocyte count and/or low haptoglobin**
  - Direct and indirect Coombs
  - Hematology consult

---

- **B12 <145**
  - Serum methylmalonic acid level
    - High
      - Treat with B12
    - Normal
      - No B12 deficiency
- **B12 145-400**
  - Other causes of anemia found
    - Treat other cause and follow Hgb/Hct
  - No other causes of anemia found
    - Refer to Page 12
Oral Iron Therapy

Begin iron sulfate, 325 mg (65 mg of elemental iron) once a day, one hour before or two hours after a meal

Intolerant of iron sulfate?

No

Continue iron sulfate

Yes

Begin Ferrous fumarate 325 mg once a day, one hour before or two hours after a meal

Intolerant of Ferrous fumarate (Tandem)?

No

Continue Ferrous fumarate 325 mg per day

Yes

Begin Elixir of Feosol, 7.5 ml (66 mg of elemental iron) once a day, one hour before meals or two hours after a meal

Intolerant of Feosol?

No

Continue Elixir of Feosol

Yes

Begin IV Iron

Repeat Hgb/Hct in 1 month

Refer to Page 9

Refer to Page 13
Repeat Hgb/Hct in 1 month

Hgb ≥ 11

- Continue iron
- Repeat Hgb/Hct every 6 months
  - Hgb ≥ 11
  - Hgb < 11

Hgb < 11 and Hgb has not increased by at least 2 g/dl over baseline

- Measure 8AM iron, TIBC, ferritin and TSAT

Hgb < 11 but Hgb has increased by at least 2 g/dl over baseline

- Continue iron
- Repeat Hgb/Hct every 1 month

Ferritin ≥ 100 and TSAT ≥ 20

- Evaluate for other causes of anemia
- Other causes found?
  - Yes
    - Treat other causes and follow Hgb
  - No
    - Consider treatment with Erythropoietin

Ferritin < 100 and/or TSAT < 20

- Ensure compliance with iron replacement, compliant?
  - Yes
    - Refer to Page 10
  - No
    - Reinforce compliance and recheck Hgb/HCT, ferritin, iron, TSAT, in 1 month

Repeat Hgb/Hct every 1 month

If Hgb < 11:

1. Incorrect diagnosis
2. Iron (blood) loss or need in excess of amount given (GI, GYN, hemolytic)
3. Malabsorption with Tissue transglutaminase IgA antibodies, total serum IgA level and osteocalcin level

Reinforce compliance and recheck Hgb/HCT, ferritin, iron, TSAT, in 1 month
Ferritin < 100 and/or TSAT < 20 and/or oral iron once a day

Is patient on iron sulfate?

Yes

Increase iron sulfate 325 mg to three times a day

Intolerant of increased due to iron sulfate?

No

Repeat Hgb/Hct in one month

Yes

Begin ferrous fumarate 325 mg a day

Intolerant of ferrous fumarate?

No

Repeat Hgb/Hct in one month

Yes

Begin Feosol 7.5 ml three times a day

Intolerant of Feosol?

No

Repeat Hgb/Hct in one month

Yes

Begin IV Iron

Is patient on ferrous fumarate 325 mg a day

Yes

Increase ferrous fumarate to 325 mg two times a day

No

Increase Feosol, 7.5 ml to three times a day

Intolerant of Feosol?

No

Refer to Page 11

Yes

Refer to Page 13
Repeat Hgb/Hct in 1 month

- $\text{Hgb} \geq 11$
  - Continue iron
  - Repeat Hgb/Hct every 6 months
    - $\text{Hgb} \geq 11$
    - $\text{Hgb} < 11$

- $\text{Hgb} < 11$ and $\text{Hgb}$ has not increased by at least 2 g/dl over baseline
  - Measure iron, TIBC, ferritin and TSAT

- $\text{Hgb} < 11$ but $\text{Hgb}$ has increased by at least 2 g/dl over baseline
  - Continue iron
  - Repeat Hgb/Hct every 1 month

- Ferritin $\geq 100$ and TSAT $\geq 20$
  - Evaluate for other causes of anemia
    - Other causes found?
      - Yes
        - Treat other causes and follow Hgb
      - No
        - Consider treatment with Erythropoietin

- Ferritin $< 100$ and/or TSAT $< 20$
  - Reevaluate patient for:
    1. Incorrect diagnosis
    2. Iron (blood) loss or need in excess of amount given (GI, GYN, hemolytic)
    3. Malabsorption with Tissue transglutaminase IgA antibodies, total serum IgA level and osteocalcin level
  - Begin IV iron
    - Refer to Page 13
Anemia of Chronic Kidney Disease
Ferritin $\geq 100$ and TSAT $\geq 20$
and other causes ruled out

Hgb $< 10$
Or
Hgb $< 11$ with symptoms felt to be directly attributed to anemia that warrant treatment

Referral to hematology for consultation.

Yes

No

Monitor ABC, ferritin, tibc, iron every 3 months (or monthly if recent fluctuations)

Hgb $\geq 10$
Ferritin $\geq 100$
TSAT $\geq 20$ without symptoms attributed to anemia warranting treatment

Consider treatment with Erythropoietin

Hgb $< 10$
Or
Hgb $< 11$ with symptoms
Ferritin $\geq 100$
TSAT $\geq 20$

Ferritin $< 100$
Or
TSAT $< 20$

Refer to Page 8 for protocol to evaluate iron supplementation and diagnosis
VENOFER PROTOCOL

Pre-medicate with:
- Famotidine 20 mg IV
- Diphenhydramine 50 mg IV
- Hydrocortisone 100 mg IV

Venofer 300 mg in 250 ml normal saline IV over 1 ½ hrs

2 weeks later

Pre-medicate with:
- Famotidine 20 mg IV
- Diphenhydramine 50 mg IV
- Hydrocortisone 100 mg IV

Venofer 300 mg in 250 ml normal saline IV over 1 ½ hrs

2 weeks later

Pre-medicate with:
- Famotidine 20 mg IV
- Diphenhydramine 50 mg IV
- Hydrocortisone 100 mg IV

Venofer 400 mg in 250 ml normal saline IV over 2 ½ hrs

2 weeks later draw CBC with diff and Ferritin, Iron and Iron Binding Capacity
Serum Phosphorus Levels

eGFR 30-59
Stage 3 CKD

Serum phosphorus level < 2.7
Increase dietary phosphorus
Refer to nutritionist for renal diet
Repeat serum phosphorus level 1 month

Serum phosphorus level 2.7-4.6
Measure serum phosphorus level every 12 months

Serum phosphorus level > 4.6
Restrict dietary phosphorus to 800-1000 mg/day
Refer to nutritionist for renal diet
Repeat serum phosphorus level monthly

Serum phosphorus level 2.7-4.6
Begin calcium-based phosphate binders and recheck serum phosphorous in 1-2 weeks

Serum phosphorus level > 4.6

Serum phosphoruss <2.7
Refer to physician

Serum phosphorus level 2.7-4.6

Serum phosphorus level > 4.6

*Keep calcium phosphorus product < 55 mg 2/dl²
Serum Phosphorus Levels

eGFR 15-29
Stage 4 CKD

Serum phosphorus level < 2.7
Increase dietary phosphorus
Refer to nutritionist for renal diet

Serum phosphorus level 2.7-4.6
Measure serum phosphorus level every 3 months

Serum phosphorus level > 4.6
Restrict dietary phosphorus to 800-1000 mg/day
Refer to nutritionist for renal diet

Repeat serum phosphorus level monthly

Serum phosphorus level 2.7-4.6

Serum phosphorus level > 4.6
Begin calcium-based phosphate binders
& recheck serum phosphorous in 1-2 weeks

Serum phosphorus level < 2.7

Serum phosphorus level 2.7-4.6

Serum phosphorus level > 4.6
Refer to physician

*Keep calcium phosphorus product < 55 mg 2/dl²*
Serum Phosphorus Levels

eGFR <15 Stage 5 CKD

Ensure patient has been referred to/is known to a nephrologist

Serum phosphorus level < 3.5

Increase dietary phosphorus
Refer to nutritionist for renal diet

Measure serum phosphorus level 1 month

Serum phosphorus level 3.5-5.5

Measure serum phosphorus level every month

Serum phosphorus level > 5.5

Restrict dietary phosphorus to 800-1000 mg/day
Refer to nutritionist for renal diet

Serum phosphorus level 3.5-5.5

Begin calcium-based phosphate binders or non-calcium, non-albumin and non-magnesium containing phosphate binding agents and recheck serum phosphorous in 1-2 weeks

Serum phosphorus level < 3.5-5.5

Refer to nephrologist

Serum phosphorus level > 5.5

Serum phosphorus level > 5.5

*Keep calcium phosphorus product < 55 mg 2/dl²
*Total Serum corrected Calcium (cCA) Levels

eGFR 30-59
Stage 3 CKD

cCA < 8.6
See Vitamin D protocol

CCA = 8.6-10.0
Measure cCA yearly

Measure 8 AM intact PTH (iPTH) level

iPTH level

If iPTH < 22, consider and workup for hypercalcemia of malignancy if appropriate

If patient taking calcium-based phosphate binders, the dose should be reduced or therapy switched to a non-calcium, non-albumin, non-magnesium containing phosphate binder. If patient taking vitamin D the dose should be reduced or discontinue

iPTH level normal or high
Refer to endocrinologist

If patient taking supplemental Vitamin D, reduce dose or discontinue Vitamin D

Measure cCA in one month

If iPTH < 22, consider and workup for hypercalcemia of malignancy if appropriate

If patient taking calcium-based phosphate binders, the dose should be reduced or therapy switched to a non-calcium, non-albumin, non-magnesium containing phosphate binder. If patient taking vitamin D the dose should be reduced or discontinue

Measure cCA in one month

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Measure cCA in one month

*Corrected total calcium (mg/dl) = total calcium (mg/dl) + 0.0704 x [34 – serum albumin (g/l)]
Total Serum corrected Calcium (cCA) Levels

eGFR 15-29
Stage 4 CKD

- **cCA < 8.6**
  - See Vitamin D protocol

- **cCA = 8.6-10.0**
  - Measure cCA every 3 months

- **cCA > 10.0** (ensure thiazide diuretics stopped, calcium supplements stopped and recheck if appropriate)
  - Measure 8 AM iPTH level
    - **iPTH level low**
      - If patient taking calcium-based phosphate binders, the dose should be reduced or therapy switched to a non-calcium, non-albumin, non-magnesium containing phosphate binder. If patient taking vitamin D the dose should be reduced or discontinue
    - **iPTH level normal or high**
      - Refer to endocrinologist

  - **Measure cCA in one month**
    - **cCA < 8.6**
      - Resume or increase calcium-based phosphate binders resume or increase Vitamin D
    - **cCA = 8.6-10.0**
      - cCA every 3 months
    - **cCA > 10.0**
      - Consider dialysis Refer to nephrology

- If iPTH < 22, consider and workup for hypercalcemia of malignancy if appropriate

- If patient taking supplemental Vitamin D, reduce dose or discontinue Vitamin D
Total Serum corrected Calcium (cCA)
Levels

eGFR < 15
Stage 5 CKD

Ensure has been referred
to/is known to nephrology

\[ \text{cCA} < 8.6 \]
See Vitamin D protocol

\[ \text{cCA} = 8.6-10.2 \]
Measure cCA every month

\[ \text{cCA} > 10.0 \]
(ensure thiazide diuretics stopped, calcium supplements stopped and recheck if appropriate)

\[ \text{iPTH level} \]

\[ \text{iPTH level low} \]
Refer to endocrinologist

\[ \text{iPTH level normal or high} \]
If patient taking supplemental Vitamin D, reduce dose or discontinue Vitamin D

\[ \text{Measure cCA in one month} \]

\[ \text{cCA < 8.6} \]
Resume or increase calcium-based phosphate binders resume or increase Vitamin D

\[ \text{cCA = 8.6-10.0} \]
Measure cCA every month

\[ \text{cCA > 10.0} \]
Consider dialysis
Refer to nephrology

If iPTH < 22, consider and workup for hypercalcemia of malignancy

If patient taking calcium-based phosphate binders, the dose should be reduced or therapy switched to a non-calcium, non-albumin, non-magnesium containing phosphate binder. If patient taking vitamin D the dose should be reduced or discontinue

Measure cCA in one month
Intact PTH Levels

- eGFR 30-59
  - Stage 3 CKD

  - iPTH level < 35
    - Measure cCA
    - Refer to Page 18

  - iPTH level 35-70
    - Measure iPTH level yearly

  - iPTH level > 70
    - Measure 25 hydroxyvitamin D level

    - 25 hydroxyvitamin D level < 30
      - Refer to Vitamin D replacement protocol

    - 25 hydroxyvitamin D level ≥ 30
      - Refer to Page 24
Intact PTH Levels

**eGFR 15-29**
Stage 4 CKD

- **iPTH level < 70**
  - Measure cCA
  - Refer to Page 18

- **iPTH level 70-110**
  - Measure iPTH level every 3 months

- **iPTH level > 110**
  - Measure 25 hydroxy Vitamin D level

- **25 hydroxyvitamin D level < 30**
  - Refer to Vitamin D replacement protocol

- **25 hydroxyvitamin D level ≥ 30**
  - Refer to Page 24
Intact PTH Levels

eGFR < 15
Stage 5 CKD

iPTH level < 150
Measure cCA
Refer to Page 19

iPTH level 150-300
Measure iPTH level every 3 months

iPTH level > 300
Measure 25 hydroxyvitamin D level

25 hydroxyvitamin D level < 30
Refer to Vitamin D replacement protocol

25 hydroxyvitamin D level ≥ 30
Refer to nephrologist

Measure 25 hydroxyvitamin D level
Refer to Vitamin D replacement protocol
Refer to nephrologist

Refer to Page 19
Intact PTH (iPTH) Level > 70 pg/ml
and
25 hydroxyvitamin D level ≥ 30
and
Serum corrected calcium (cCA) < 9.5 mg/dl
and
Serum phosphorus < 4.6 mg/dl
and
Calculated cCA x P product < 55

Yes

Begin Zemplar (paricalcitol) 1 mcg daily

Measure iPTH in 12 weeks

Refer to Page 25

Measure serum phosphorus (P) in 12 weeks

Refer to Page 27

Measure corrected serum calcium (cCA) in 12 weeks

Refer to Page 28

Calculate cCA x P product in 12 weeks

Refer to Page 29

No

Physician to reevaluate patient
Page 24

eGFR = 15-29
Stage 4 CKD

Intact PTH (iPTH) Level > 110 pg/ml
and
25 Hydroxyvitamin D level ≥ 30
and
Serum corrected calcium (cCA) < 9.5 mg/dl
and
Serum phosphorus < 4.6 mg/dl
and
Calculated cCA x P product < 55

Yes

Begin Zemplar (paricalcitol) 1 mcg (2 gel caps) daily

Physician to reevaluate patient

No

Measure BiPTH in 12 weeks
Refer to Page 26

Measure serum phosphorus (P) in 12 weeks
Refer to Page 27

Measure calculated serum calcium (cCA) in 12 weeks
Refer to Page 28

Calculate cCA x P product in 12 weeks
Refer to Page 29
iPTH Level
Stage 3 CKD

iPTH < 35
Hold Zemplar
Repeat iPTH in 3 month

iPTH 35-70
iPTH decreased by ≤ 25%
Maintain dose Zemplar
iPTH decreased by > 25%
Decrease dose Zemplar

iPTH > 70
iPTH decreased by < 30%
Increase dose Zemplar
iPTH decreased by ≥ 30 - ≤ 60 %
Maintain dose
iPTH decreased by > 60%
Decrease dose Zemplar

iPTH < 35
Restart Zemplar at lower dose
Measure iPTH in 3 months

iPTH 35-70
Repeat iPTH level in 3 months

iPTH > 70
Repeat iPTH level in 3 months

Low dose Zemplar – 1 mg three times a week, not more than every other day.
Routine dose Zemplar – 1 mg daily.
High dose Zemplar – 2 mg three times a week, not more than every other day.
iPTH Level
Stage 4 CKD

**iPTH < 70**
- Hold Zemplar
  - Repeat iPTH in 3 month
    - iPTH < 35
      - Restart Zemplar at lower dose
        - Measure iPTH in 3 months
    - iPTH 35-70
    - iPTH > 70

**iPTH 70-110**
- iPTH decreased by ≤ 25%
  - Maintain dose Zemplar
- iPTH decreased by > 25%
  - Decrease dose Zemplar
- iPTH increased or decreased by < 30%
  - Increase dose Zemplar
- iPTH decreased by > 60%
  - Decrease dose Zemplar

**iPTH > 110**
- iPTH decreased by ≥ 30 - ≤ 60%
  - Maintain dose
- iPTH decreased by > 60%
  - Repeat iPTH level in 3 months

Low dose Zemplar – 1 mg three times a week, not more than every other day
Routine dose Zemplar – 1 mg daily
High dose Zemplar – 2 mg three times a week, not more than every other day
Serum Phosphorus

Serum phosphorus ≤ 4.6
- Maintain dose of Zemplar
- Repeat Serum Phosphorus in 3 months

Serum phosphorus > 4.6
- Stop Zemplar
- Repeat serum phosphorus in 4 weeks
  - Serum phosphorus ≤ 4.6
    - Resume Zemplar
  - Serum phosphorus > 4.6
    - Stage 3 CKD
      - Refer to Page 14
    - Stage 4 CKD
      - Refer to Page 15
    - Stage 5 CKD
      - Refer to Page 16

Refer to Page 14
Refer to Page 15
Refer to Page 16
Serum Corrected Calcium (cCA)

- If Serum cCA ≤ 9.5:
  - Maintain dose of Zemplar
  - Repeat Serum cCA in 3 months

- If Serum cCA > 9.5:
  - Stop Zemplar
  - Repeat serum cCA in 4 weeks
  - If Serum cCA ≤ 9.5:
    - Resume Zemplar
    - At lower dose if appropriate
  - If Serum cCA > 9.5:
    - Refer to:
      - Stage 3 CKD: Refer to Page 17
      - Stage 4 CKD: Refer to Page 18
      - Stage 5 CKD: Refer to Page 19
cCA x P Product

- cCA x P < 55
  - Maintain dose of Zemplar
  - Repeat cCA x P in 3 months

- cCA x P ≥ 55
  - Stop Zemplar
  - Repeat cCA x P in 4 weeks
    - cCA x P ≤ 55
      - Resume Zemplar
      - At lower dose if appropriate
    - cCA x P > 55