

## **Type 2 Diabetes and Chronic Kidney Disease**

CKD is an eGFR <60ml/min **or** kidney damage for 3 months or more (e.g. urine sediment, abnormal imaging, or albuminuria (UACR <30mg/g = nl, 30-300 = micro, >300 = macro)).

**Table 1 Stages of Chronic Kidney Disease (CKD) and Diagnostic Levels**

	1	2	3	4	5
eGFR*	> 60ml/min	> 60ml/min	3 to 59 ml/min	15 to 29 ml/min	<15ml/min
Proteinuria	microalbuminuria	macroalbuminuria			

\*estimated Glomerular Filtration Rate

**Markers of progression:** decreasing eGFR, increasing albuminuria and poor BP control.

### **Workup of CKD and to r/o non-diabetes causes**

CMP, UA, UACR, Uric Acid, Phos, CBC, ANA, RF, C3, C4, HepB sAg, HepC Ab, dilated retinal exam, and renal U/S. If pt >40 yrs & UACR is positive, then check SPEP and UPEP.

### **Referrals**

**Nephrologist:** Make a referral when the eGFR <30ml/min or sooner if unsure of etiology of renal disease or problems occur.

**Nutrition:** Make a referral to a Registered Dietitian (RD) for consult on protein, Na<sup>+</sup>, K<sup>+</sup>, PO<sub>4</sub>, fluids and saturated fat.

### **Managing Complications of CKD in Stages 3 to 5**

#### **Acidosis**

If the serum CO<sub>2</sub> <2mmol/L, start sodium bicarbonate 325 to 650mg; give 1to 2 tablets TID or QID. Goal is CO<sub>2</sub> >2mmol/L.

#### **Anemia**

**Check hemoglobin (Hb) at least yearly:** Anemia is a HB <13.5 g/dL in adult men and <12 g/dL in adult woman. R/o other causes of anemia such as B12 and folate deficiency, GI blood loss and other causes.

**Baseline Labs:** Ferritin, transferrin, % Sat, iron studies (Fe, % Sat, TIBC), and CBC + differential.

Start oral iron therapy if ferritin and/or iron studies find low values.

- Ferrous Sulfate (FeSO<sub>4</sub>) 325mg daily to TID. Consider docusate 100mg TID to reduce constipation. **Monitor ferritin levels to avoid iron overload.**
- Consider IV iron or blood transfusion if needed.
- Safety of erythropoiesis stimulating agents (ESA) IS unclear; reserve for pt on dialysis, pending renal transplant, or Hb less than 9 with symptoms unresponsive to treatment above.

#### **Blood Pressure**

*Most effective CKD intervention:* BP goal <130/80; continue ACEI/ARB (watch K+)

## Cardiovascular Disease (CVD)

CKD increases CVD risk; patients should take aspirin if no contraindications exist. Achieve lipid targets and encourage tobacco cessation.

## Diabetes

**Blood sugar control**—as renal function declines, a pts blood glucose often improve; titrate medications down as needed. Caution should be used in setting an A1c target <7% if advanced CKD or CVD is present.

**D/C metformin when Creatinine is >1.5mg/dL in men or >1.4 mg/dL in women.**

**Peripheral Neuropathy:** Foot ulcers are common. Check pts feet each visit and refer to a shoe clinic.

**Retinopathy:** Schedule Ophthalmology visits regularly to check for retinal damage.

**Autonomic Neuropathy:** Frequent blood pressure fluctuations, including orthostatic symptoms.

## Edema/Fluid Overload

Establish pts dry weight.

Titrate furosemide as needed 20-240mg BID. Diuresis lasts 6 hour so give in the morning and at mid-day.

## Metabolic Bone Disease

**Evidence Based: Phosphorus (PO<sub>4</sub>):** if >4.6 mg/dL, start binder (calcium); Refer to RD for dietary PO<sub>4</sub> restriction.

**Calcium (Ca):** target: 8.4 to 9.5 mg/dL

If < 8.4, start or increase calcium supplementation

If > 10.2, correct causes (often secondary to medications; need to hold Ca and/or Vitamin D or calcitriol

**Consensus Opinion:** If iPTH is elevated, measure 25(OH)D (Vitamin D).

If 25(OH)D ≥ 30mg/mL, start calcitriol

If 25(OH)D < 30mg/mL, start ergocalciferol (Vit D2)

Follow Ca, PO<sub>4</sub>, iPTH, and 25(OH)D; if Ca or PO<sub>4</sub> is above target or if iPTH below target, hold calcitriol and/or calcium.

**Table 2. Stage of CKD and Metabolic Monitoring Goals**

CKD Stage	eGFR	iPTH goal	PO <sub>4</sub> goal	Ca goal	Ca X PO <sub>4</sub>
3	30-59	35-70	2.7-4.6	8.4-9.5	<55
4	15-29	70-110	2.7-4.6	8.4-9.5	<55
5	< 15	150-300	3.5-5.4	8.4-9.5	<55

**Table 2. Phosphate Binders\*: Dose and Effect on Metabolic Status**

Medication	Dose	iPTH effect	PO <sub>4</sub> effect	Ca effect	Comments
**CaCO <sub>3</sub> (Oyst-Cal or TUMS)	500-2000mg with meals	No change	Decrease	Increase	Use if Ca <8.4; no more than 7g/day
**Ca Acetate	1334-2868mg with meals	No change	Significant decrease	Increase	Use if Ca < 8.4 and PO <sub>4</sub> > 5
**Sevelamer (Renagel)	800-1600mg TID	No change	Significant decrease		Decrease PO <sub>4</sub> , no effect on Ca; cost
**Lanthanum	1500-3750mg/day with meals	No change	Significant decrease	Decrease	Decrease PO <sub>4</sub> and Ca; cost
**Aluminum	600-1200mg TID between meals & HS	No change	Significant decrease	No change	ONLY if PO <sub>4</sub> > 7 and Ca x PO <sub>4</sub> > 55; not more than 30 days due to toxicity

\*Always include dietary phosphorous restriction

\*\* Drugs are not on the IHS National Core Formulary

**Table 3. Vitamin D and Analogs; Dose and Effect on Metabolic Status**

Medication	Dose	iPTH effect	PO <sub>4</sub> effect	Ca effect	Comments
*Vit D <sub>2</sub> (Ergocalciferol)	1.25-5mg daily	Decrease	No change	Significant increase	Use if Vit D <30mg/mL
*Calcitriol	0.25-1mcg daily or 0.5-3mcg TIW	Decrease	No change	Significant increase	Use only if Ca & PO <sub>4</sub> in normal range. Hold if Ca x PO <sub>4</sub> >55
*Doxercalciferol	1-3mcg daily or 10-20mcg TIW	Decrease	No change	Increase	Use only if Ca & PO <sub>4</sub> in normal range. Hold if Ca x PO <sub>4</sub> >55

\*Drugs are not on the IHS National Core Formulary

**Table 4. Other Medication**

Medication	Dose	iPTH effect	PO <sub>4</sub> effect	Ca effect	Comments
*Cinacalcet	30-180mg daily	Decrease	Decrease	Significant decrease	Do not use if Ca <8.4

\*Always include dietary phosphorous restriction

Drugs in italics are not on the IHS National Core Formulary

**Table 5. Lab Monitoring for CKD**

Parameter	GFR > 60	GFR 30-59	GFR 15-29	GFR < 15 not on dialysis
Creatinine	Annual	Each visit	Each visit	Each visit
eGFR	Annual	Each visit	Each visit	Each visit
UACR	Annual	Every 3 to 6 months*	Each Visit*	Each Visit*
Hb	Annual	Every 3 months	Every 3 months	Every 3 months
Serum iron		Every 3 months	Every 3 months	Every 3 months
Transferrin Saturation		Every 3 months	Every 3 months	Every 3 months
Ferritin		Every 3 months	Every 3 months	Every 3 months
iPTH		At least annually	Every 3 months	Every 3 months
Ca & PO <sub>4</sub>		At least annually	Every 3 months	Every 3 month

Monitor more often if values are worsening or on medications that affect these labs

\*Frequency of checking depends on rate of rise of urine albumin

**Reference:** KDOQI/NKF and UK Renal Assoc 4<sup>th</sup> Ed. Clinical Practice Guidelines for Complications of CKD.

ADA Clinical Practice Recommendations 2010.

J Am Soc Nephrol 2010; 21:2-6.