The Diabetes – Kidney Disease Connection
Missouri Foundation for Health
February 26, 2009

Teresa Northcutt, RN BSN
Primaris Program Manager, Prevention - CKD
Objectives

- Define kidney disease, relationship to diabetes
- Identify risk factors, causes, complications of CKD
- Identify who, when, and how to screen for CKD
- Describe treatment guidelines to slow progression and reduce complications
Diabetes

- Stroke
- Heart Attack
- Early Death
- CKD
- High Blood Pressure
Kidney disease – A Growing Problem

- 26 million people (1 in 20) have CKD; only 10% know it.
- >90,000 people die annually from diseases of kidney & urinary tract; 9th leading cause of death in US and MO.
- In 2005, >100,000 new pts started treatment for kidney failure.
- >485,000 people in U.S. with kidney failure as of 12/31/05.
- By 2010, estimated 650,000 Americans will have kidney failure.
- In Heartland Kidney Network (MO, KS, NE, IA) – 51% of all ESRD patients reside in MO.
What is Kidney Disease?

- Early kidney disease has no symptoms and is frequently undetected. Left untreated, will progress to kidney failure - requiring dialysis or transplant to prevent death.

- Chronic Kidney Disease (CKD) is kidney disease, due to any cause that is unlikely reversible.

- Diabetic Kidney Disease (DKD) is kidney disease caused by Type 1 or Type 2 diabetes.
Functions of the Kidneys

- Balance body’s fluids
- Form urine
- Balance electrolytes in body
- Eliminate wastes and excess acid in blood
- Regulate bicarbonate to maintain acid-base balance
- Synthesize prostaglandin and produce hormones:
  - Renin-angiotensin system to control blood pressure
  - Erythropoiesis to maintain red blood cells
  - Activation of Vitamin D for healthy bones
NKF Definition of Chronic Kidney Disease

Kidney damage for three or more months based on findings of abnormal structure (imaging studies) or abnormal function (blood tests, urinalysis)

OR

GFR < 60 mL per minute per 1.73 m² for three or more months with or without evidence of kidney damage
Signs of Kidney Damage

Damage to kidneys may or may not involve kidney failure. Examples of signs of damage include:

- Blood in urine (Hematuria)
- Protein in urine (Proteinuria)
- Abnormal blood or other urine tests
- Abnormal imaging tests
- Abnormal kidney biopsy
Causes of Kidney Damage

- Diabetes
- Hypertension
- Autoimmune Diseases
- Recovery from Acute Kidney Failure
- Urinary tract infections
- Kidney stones or urinary tract obstruction
- Systemic infection
- Drug toxicity
- Neoplasms
Incident Counts and Rates of ESRD by Primary Diagnosis

USRDS 2006
Factors Increasing Kidney Damage

- Uncontrolled high blood pressure
- Uncontrolled diabetes
- Excessive proteinuria
- Smoking
- High Cholesterol
Complications associated with CKD

- Cardiovascular Disease
- Hypertension
- Anemia
- Bone disease
- Metabolic acidosis
- Malnutrition
- Dyslipidemia
- Decreased overall function, depression
CKD and Cardiovascular Disease

- Small loss of kidney function can double the risk of developing cardiovascular disease
- Many CKD patients have heart attacks or strokes before they’re aware of their CKD
- Heart disease accounts for 40-50% of CKD deaths
- Early detection of CKD, along with appropriate therapy, can help prevent heart problems and slow progression rate of kidney failure
Diabetes – Kidney Disease Connection

Kidney disease is frequent complication of diabetes

- Type 1 Diabetes – approximately 30% develop DKD
- Type 2 Diabetes – approximately 40% develop DKD

Diabetes is common in ESRD

- 45% of incident patients have DM as primary renal diagnosis, most common cause of ESRD
- Total diabetes burden in prevalent patients is 66-86%, depending on race
Incidence of Diabetic ESRD: Whites, 1992
USRDS 2004
Incidence of Diabetic ESRD: Whites, 2002
USRDS 2004
CKD Prevention targets Diabetes & HTN

More than 90% of Medicare patients with CKD also have diabetes and/or hypertension.

Approximately 83,000 Medicare beneficiaries with diabetes in Missouri (Fee-for-Service 4/06-3/07).

Diabetes and hypertension both cause CKD, and exacerbate complications of CKD.
KDOQI Guidelines

Kidney Disease Outcomes Quality Initiative (KDOQI) from the National Kidney Foundation has developed guidelines for the detection, evaluation, and treatment of chronic kidney disease.

NKF Clinical Practice Guidelines for Patients with CKD:

http://www.kidney.org/professionals/kdoqi/guidelines_ckd.toc.htm

Identify – Plan - Manage
Chronic Kidney Disease Screening

PERCENT OF MEDICARE PATIENTS BY COUNTY WITH DIABETES WHO HAVE HAD AN ANNUAL MICROALBUMIN SCREENING

DATA SOURCE:
Medicare Fee-For-Service claims data representing claims between 1/1/2007 to 12/31/2007.
Identify CKD through Screening

Assess every patient for kidney disease risk factors

“At-risk” patients that should be screened for CKD:

- Diabetes
- Hypertension
- Family history of kidney disease or failure
- Recurrent urinary tract infections or urinary obstruction
- Systemic illness that affects the kidneys
- Over 60 years of age
Screening Tests For All “At-Risk” Patients

Analysis of a random urine sample for the albumin-to-creatinine ratio to quantify proteinuria

- Screening for proteinuria can indicate the presence of CKD long before changes in the GFR
- Two positive samples within 3 months

Blood test to measure serum creatinine level, used to calculate an estimated glomerular filtration rate (eGFR)

KDOQI Guideline 1
What is GFR?

- GFR is Glomerular filtration rate, an indication of the filtering capacity of the kidneys.
- GFR is the best overall index of kidney function in health and disease.
- Estimation of GFR based on serum creatinine level correlates better with direct measurements of GFR and detects more cases of CKD than serum creatinine level alone.
Estimating the GFR: “eGFR”

- GFR estimates are calculated from measured serum creatinine level, adjusted for age, sex, body size, and race using a prediction equation (MDRD Study equation recommended by KDOQI)

- Many labs include eGFR on blood panel results

- GFR calculators are available online and from various vendors
Applications of eGFR

- KDOQI Guidelines define stages of CKD based on estimated GFR
- Monitoring eGFR indicates if treatment goals are achieved
- Used to determine dosing of renal excreted medications, including safety of contrast dyes for diagnostic testing (nephrology consult to reduce potential complications and adverse effects)
Diagnosis of Diabetic Kidney Disease

- **Macroalbuminuria**: Urine ACR >300 mg/g
- **Microalbuminuria**: Urine ACR 30-300 mg/g
  - Presence of diabetic retinopathy
  - Type 1 diabetes for at least 10 years
Timeline for Diabetic Kidney Disease

- **Onset of Hyperglycemia**
  - **DIABETES**
  - High GFR
  - Normal GFR
  - Low GFR
  - Cellular Injury
  - Glomerulosclerosis and Tubulointerstitial Fibrosis
  - Rising Blood Pressure
  - Hypertension
  - Microalbuminuria
  - Macroalbuminuria
  - Rising Blood Creatinine
  - End-Stage Kidney Disease

- **Cardiovascular Death**
CKD screening frequency for adults

- **Type 1 Diabetes:** after 5 years, then annually*
- **Type 2 Diabetes:** at diagnosis, then annually*
- **Hypertension:** at diagnosis and initiation of therapy, then every 3 years if normal eGFR and microalbumin tests
- **Family history of kidney disease:** every 3 years, if normal test results
- **Testing intervals are recommendations; physicians may use professional discretion**

*KDOQI Guideline 1
Stages of CKD

There are five stages of CKD

As the patient’s Glomerular Filtration Rate decreases, the CKD stage increases

- Normal eGFR for white female = 100 mL/min/1.73 m²
- Normal eGFR for white male = 120 mL/min/1.73 m²
“At–Risk” for CKD

- eGFR > 90
- CKD risk factors present

**Actions:**

- Annual screening microalbumin and eGFR
- Risk factor reduction: smoking cessation, cholesterol control, avoid illicit and nephrotoxic drug use, maintain appropriate weight
CKD Stage 1

- Kidney damage
- Normal eGFR (≥ 90)

Actions:
- Screening and diagnosis
- Interventions to slow disease progression
- Treatment of co-morbid conditions
- Reduction of risk factors for cardiovascular disease
CKD Stage 2

Kidney damage

Mildly decreased eGFR (89-60)

Actions:

- Estimate disease progression
- Preserve upper extremity veins (avoid venipuncture, IV caths, or PICC lines in non-dominant arm)
CKD Stage 3

- Moderately decreased eGFR (59-30)

Actions:
- Evaluation and treatment of disease complications
- Referral to nephrologist for co-management of serum electrolytes (calcium, phosphorus, PTH levels) and anemia
- Education on ESRD treatment options
CKD Stage 4

- Severely decreased eGFR (29-15)

- Actions:
  - Preparation for kidney replacement therapy, education on vascular access options
  - Evaluation by vascular surgeon for AV fistula placement if patient is considering hemodialysis
  - Evaluate potential kidney donors
CKD Stage 5

- Kidney failure; or ESRD – End Stage Renal Disease
- eGFR (< 15)
- Irreversible decline in kidney function, severe enough to be fatal without dialysis or transplantation

Actions:

- Kidney replacement therapy if uremia is present
Plan and Manage CKD

Early Stages of CKD

- Determine stage, establish cause, evaluate comorbidities
- Time to educate, plan and adjust to disease process

Later Stages of CKD

- Requires more aggressive treatment; less time available for teaching, planning, vascular access creation, etc.
- Still better than untreated and undiagnosed ESRD patient presenting in ER requiring immediate dialysis
Treatment Goals for all CKD patients

- Identify and monitor disease stage
- Slow disease progression
- Detect and manage complications
- Prevent cardiovascular disease
- Educate patient on self-management responsibilities and treatment options
Interventions to slow progression

- Glycemic control in diabetic patients
- Blood pressure control
- Reduction of proteinuria with an ACE inhibitor or ARB
- Lipid management
- Anemia management
- Nutrition and weight management
Glycemic Control in Diabetics

- Monitor fasting blood glucose and hemoglobin A1C
- Target hemoglobin A1C for all people with diabetes should be <7.0%, irrespective of the presence or absence of CKD

KDOQI Guideline 2
Blood Pressure Control

- Hypertensive people with diabetes and CKD Stage 1-4 should be treated with ACE inhibitor or ARB, usually in combination with diuretic.

- Target BP in diabetes and CKD of <130/80 mmHg for patients with normal urinary albumin concentrations.

- Target BP of <125/75 mmHg for patients with proteinuria ≥ 1 g/24 hours.

KDOQI Guideline 3
Reduce Microalbuminuria

- Defined as 30-300 mg albumin / 24 hours
- Heralds onset of diabetic nephropathy, more rapid progression of CKD, earlier ESRD
- Consider treating normotensive patients with diabetes and microalbuminuria with ACE inhibitor or ARB
- Albuminuria reduction is treatment target in DKD
- For patients already on ACE or ARB, monitor for presence of microalbumin, adjust dose as tolerated, with goal of eliminating albuminuria
ACE / ARB Treatment

Goal: all patients with diabetes diagnosis, hypertension, and CKD will receive ACE/ARB treatment, if appropriate, to slow progression of CKD

- MO: only 53% of Medicare patients with diabetes and CKD were on ACE/ARB medication
- Jan. 06 - June 07: use of ACE/ARBs by Medicare patients increased nationally by 3.6%, but declined by 3.2% in MO
Lipid Management

- Measure total cholesterol, HDL and LDL
- Target LDL in people with diabetes & CKD stage 1-4: <100 mg/dl
- People with diabetes & CKD stage 1-4 and LDL ≥ 100 mg/dl should be treated with statin

KDOQI Guideline 4
## Anemia Assessment

### Lab tests
- Hemoglobin & hematocrit
- Reticulocytes
- Iron and Ferritin
- % of transferrin saturation
- B-12 and Folate
- PTH
- Stool for occult blood, other causes of anemia

### History & Physical
- Energy, activity level
- S/Sx of fatigue
- Dyspnea
- Pallor
- Appetite, weight loss
- Sexual function
- Quality of life
Anemia Management

- Target hemoglobin 11-13 g/dl for patients with CKD stages 4-5
- Iron replacement (oral or intravenous) if ferritin is <100 ng/ml or % of transferrin saturation is <20%
- Vitamin supplements if indicated
- Assess for other cause(s) of anemia; administer Erythropoetin if indicated
Anemia Increases Stroke Risk in CKD patients

Adjusted Risk of Stroke According to Renal Function and Hb Level

- Anemia if Hb < 12 g/dL for men and < 13 g/dL for women
- CrCl = creatinine clearance

Relative Risk of Stroke

CrCl > 60 ml/min
CrCl < 60 ml/min

Anemia if Hb < 12 g/dL for men and < 13 g/dL for women
CrCl = creatinine clearance
Nutrition Management

- Malnutrition and protein intake must be addressed; patients run higher risk of mortality when serum albumin is low.

- Target serum albumin \( \geq 3.5 \text{ g/dl} \) for patients with CKD Stages 4-5.

- Target dietary protein intake for diabetes and CKD stage 1-4 is RDA of 0.8 g/kg body weight/day.

KDOQI Guideline 5
Weight Management

- Target BMI for diabetes & CKD should be within normal range (18.9 – 24.9)

- Provide CKD patients with tools for weight control
  - List of low glycemic index foods
  - Program for easy exercise
  - Set weight loss goals (short and long term)
  - Provide frequent follow-up and encouragement
  - Assess for symptoms of underlying depression
ESRD Treatment Modality Choices

- Hemodialysis: at home or in-center, 3x/wk or nightly
- Peritoneal Dialysis: at home, daily
- Kidney Transplant
- No treatment (death)
Dialysis: Vascular Access Planning

Stage 4 CKD patients considering hemodialysis need evaluation for arteriovenous fistula by vascular surgeon; takes approximately 6 months for AVF to mature prior to patient starting dialysis.

AVF is the gold standard for vascular access: lasts longer, less rework/repair, lower rates of infection, hospitalization and death.

For more information: www.fistulafirst.org
2007 State AVF% in Prevalent Patients
Interventions to Increase AVF Rates

- Preserve upper extremity veins: no venipunctures or IVs in non-dominant arm, no central lines on that side
- Early hemodialysis discussion (Stage 3) as treatment option and AV fistula as gold standard for vascular access
- Timely evaluation by vascular surgeon (Stage 4) to determine if patient is candidate for AVF placement
Identify – Plan - Manage

**Identify** patients with CKD by screening for urine microalbumin and serum creatinine for eGFR

**Plan** – develop treatment plan to control diabetes, HTN, and proteinuria; use ACE and ARB meds to slow CKD progression and reduce cardiovascular risks

**Manage** – primary care physician and nephrologist co-manage to provide ongoing monitoring and treatment of complex issues as CKD progresses, including preparation for renal replacement
Primaris CKD Prevention Team

Teresa Northcutt, RN BSN
CKD Program Manager (East) tnorthcutt@primaris.org

Sharon Bunnell, BSN RN CNN
CKD Program Manager (West) sbunnell@primaris.org

Paulette Strader, CKD Project Director
1-800-735-6776, ext. 205 or pstrader@primaris.org
“The future started yesterday, and we’re already late.”

~John Legend

Thank you for working to decrease the increase in Chronic Kidney Disease for Missourians!