NUTRITION CONSIDERATIONS FOR PATIENTS WITH DIABETES AND ADVANCED KIDNEY DISEASE

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CONFICTS OF INTEREST

In compliance with the accrediting board policies, the American Diabetes Association requires the following disclosure to the participants:

Becca Wallschlaeger, MS RDN:

Disclosed no conflict of interest

OBJECTIVES

- Recognize kidney disease is a growing epidemic, much like diabetes, and obesity
- Understand relationship between diabetes and kidney function
- Identify nutrition changes for people living with diabetes and advanced kidney disease
- Understand kidney replacement options and the nutrition implications of each
OVERVIEW

- Background
- Anatomy and Physiology of Renal Organ System
- Diabetic Kidney Disease
- Nutrition Implications and Changes in Advanced Kidney Disease
- Kidney Replacement Options
- Nutrition and Diabetes in Kidney Replacement

KIDNEY DISEASE FACTS

- More than 20 million (or more than 10%) US adults are estimated to have CKD and most are undiagnosed
- Kidney disease is the 9th leading cause of death in US
- In the US, diabetes and hypertension are the leading causes of kidney failure, accounting for 72% or about ¾ of new cases
- The number of kidney failure cases in the US population has more than tripled since 1990

Centers for Disease Control and Prevention, CKD Initiative, 2015

Figure 1.1 Prevalence of CKD by stage among NHANES participants, 1999-2014

Data Source: National Health and Nutrition Examination Survey (NHANES), 1999-2014. Whisker bars indicate 95% confidence interval; abbreviations: CKD, chronic kidney disease.
DETECTION OF CKD IN DIABETICS

Centers for Disease Control and Prevention, 2015

DIAGNOSIS COMMUNICATION

Centers for Disease Control and Prevention, CKD Initiative, 2015

HEALTHY PEOPLE 2020—DM & CKD

Goal: Reduce the disease burden of DM and improve the quality of life for all people who have, or are at risk for, DM
16 Objectives
   • https://www.healthypeople.gov/2020/topics-objectives/topic/diabetes/objectives

Goal: Reduce new cases of CKD and its complications, disability, death, and economic costs
   • Nearly 25% of the Medicare budget is used to treat people with CKD and ESRD.
14 Objectives
   • https://www.healthypeople.gov/2020/topics-objectives/topic/chronic-kidney-disease/objectives

Office of Disease Prevention and Health Promotion, Healthy People 2020, 2017
Table 2.2 HP2020 D-12 Increase the proportion of persons with diagnosed diabetes who obtain an annual urinary microalbumin measurement: Target 37.0%

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KIDNEY PHYSIOLOGY

- Filters Blood
  - Glomerular Filtration
  - Tubule Secretion
  - Tubule Resorption
- Removes Toxins
- Regulates Extracellular Homeostasis
  - Acid/base
  - Electrolytes
  - Fluids
- Blood Pressure Control
- Makes Erythropoietin
- Vitamin D Metabolism

KIDNEY ANATOMY
STAGES OF CKD

- Stage 1: $eGFR \geq 90 \text{ ml/min/1.73m}^2$ and ACR $\geq 30 \text{ mg/g}$
- Stage 2: $eGFR 60-89 \text{ ml/min/1.73m}^2$ and ACR $\geq 30 \text{ mg/g}$
- Stage 3: $eGFR 30-59 \text{ ml/min/1.73m}^2$
- Stage 4: $eGFR 15-29 \text{ ml/min/1.73m}^2$
- Stage 5: $eGFR < 15 \text{ ml/min/1.73m}^2$

ADVANCED KIDNEY DISEASE

- Stage 4 or GFR <30 mL/min
- Quality vs quantity – clearance
- Symptoms
  - Fluid build up
  - Loss of appetite
  - Changes in sleep
  - Changes in concentration
- Monitoring
  - Urine
  - Blood

DIABETES AND PROGRESSION OF KIDNEY DISEASE

- Hyperglycemia
- Filtration rate
- Leaking
- Loss of protein
  - Microalbuminuria (early stages)
  - Macroalbuminuria (nearing ESRD)
- Loss of filtering
- Waste build up
- Dialysis/Transplant
GLUCOSE CONTROL AND MICROALBUMINURIA

- KDOQI Guideline 2
- "Intensive treatment of hyperglycemia prevents elevated albuminuria or delays its progression"
- Recommend: HbA1c of ~7% to prevent or delay progression of microvascular complications of diabetes (Diabetes Control and Complications Trial)
- Recommend: Not treating to HbA1c <7% in patients at risk of hypoglycemia
- ADVANCE Trial

DIABETES CONTROL AND COMPLICATIONS TRIAL

11,140 participants
Randomly assigned
- Intensive glucose-lowering strategy
- Standard glucose control
Measures
- ESRD Risk
- Microalbuminuria
- Macroalbuminuria
Results:
- HbA1c level was 6.5% in intensive group, and 7.3% in standard group
- Significant reduction in ESRD risk by 65%, microalbuminuria in intensive group
- Significant reduction in microalbuminuria by 9%
- Significant reduction in macroalbuminuria by 30%
RENAL INSUFFICIENCY & DIABETIC CHANGES
- Insulin metabolism
  - Glomerulus
  - Peritubular Capillaries
- Impaired renal function = impaired insulin metabolism
- Prolonged half-life of circulating insulin

RENAL DIET
- KDOQI guidelines
- Academy of Nutrition and Dietetics Position
- DASH Diet
- Diabetic Diet
- Typical Concerns
  - Sodium
  - Potassium
  - Phosphorus
  - Calcium
  - Protein

ACADEMY OF NUTRITION AND DIETETICS
- Evidence Analysis Library
- CKD Guideline
- CKD Toolkit
- Based on KDOQI Guidelines
- Medical Nutrition Therapy
DASH DIET
- 1,500-2,300 mg sodium/day
- Grains: 6-8 servings/day whole grains or sweet potatoes
- Vegetables: 4-5 servings/day
- Fruit: 4-5 servings/day
- Dairy: 2-3 servings/day (Low- or Non-Fat)
- Lean Protein: ≤ 6 oz/day
- Nuts, Seeds, Beans: 4-5 servings/week
- Fats & Oils: 2-3 servings/day (unsaturated)
- Sweets: ≤ 5/week

DIABETIC DIET
- Consistent meal times; avoid skipping meals
- Reduce sugar and sweets
- Consistent meal composition
  - My Plate
  - Include a lean protein source at meals and snacks
- Choose high-fiber foods
- Eat less fat
KDOQI GUIDELINES: PROTEIN

- GFR < 50 mL/min per 1.73 m²
  - 0.8 gram protein/kg/day (IBW if BMI > 30 kg/m²)
  - Ensure adequate caloric intake to prevent malnutrition
- GFR < 20 mL/min per 1.73 m²
  - 0.2-0.5 gram protein/kg/day (IBW if BMI > 30 kg/m²)
  - Keto acid analogs
  - Vitamin/Mineral supplementation
- Diabetic Nephropathy
  - 0.8-0.9 gram protein/kg/day (IBW if BMI > 30 kg/m²)
  - Prevent hypoalbuminemia
- Dialysis
  - 1.2 gram protein/kg/day (IBW if BMI > 30 kg/m²)

RESTRICTING DIETARY PROTEIN

Chronic kidney disease progression: a retrospective analysis of 3-year adherence to a low protein diet

- 321 enrolled patients; 2008-2013
- Provided with KDOQI guidelines
- Followed every 3 months by RD
- Diet records with analysis
- Adherence defined 90-110% of diet prescription
  - Motivation additionally self-measured by patient
    - Excellent, very good, fair, poor
- 4 groups
  - DM adhered
  - DM did not adhered
  - Non-DM adhered
  - Non-DM did not adhered

RESULTS:

- Adherence: 49.2% (25% DM 23% non-DM)
- Significant improvement in fasting glucose in group 1
- Creatinine levels decreased significantly in adherent groups
- E-GFR increased significantly year-to-year in adherent groups with albumin in normal range (>3.8 mg/dL)
- No protein-energy wasting found
- Limitation: did not evaluate blood pressure or proteinuria
KDOQI GUIDELINES: POTASSIUM (K)
- No restrictions until K is > 5.5 mg/dL
  - < 2.4 gram/day if hyperkalemic
- Restrict K intake to 3-4 g/day CKD
- Restrict K intake to 2-3 g/day ESRD
- Misc: multivitamins, sports drinks, salt alternatives, diuretics/blood pressure medications
- Common Sources
  - Dairy
  - Nuts
  - Produce
  - Dried fruits
  - Processed foods

KDOQI GUIDELINES: PHOSPHORUS
- Restrict if serum level is > 4.6 mg/dL
- 800-1,000 mg/day
- RDA healthy population: 700-1250 mg/day
- Average intake: 1400-2000 mg/day
- Common sources:
  - Dairy
  - Meats/Eggs
  - Nuts
  - Whole grains
  - Processed foods

THE PHOSPHORUS PYRAMID
D’alessandro et al, BMC Nephrology, 2015
**PHOSPHATE BINDERS**

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*Capicuin dose is equivalent to plastic*

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**SODIUM & FLUIDS**

- **Sodium**
  - Based upon blood pressure and fluid balance
  - Stages 1-5 ≤ 2.4 gram/day
  - Dialysis ≤ 2.0 gram/day

- **Fluids**
  - No restrictions Stages 1-3
  - Stage 4: output +1000 mL
  - HD: 1.5-2 L, depending on output and ID gains
  - PD: 1-3 L/day

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**DIALYSIS**

- **Kidney replacement therapy**
- **Access Types**
  - Fistula: artery-vein connection in arm
  - Graft: use of plastic tube to join artery-vein in arm
  - Catheter: plastic tube inserted into large vein in neck
- **Dialysis Modalities**
  - Hemodialysis
    - In Center
    - Home
  - Peritoneal Dialysis
    - CAPD
    - Cyclic PD
- **RD Assessment monthly-CMS requirement**
  - Additional assessments “Care Conferences”
COMMON MEDICATIONS AND SUPPLEMENTS

- No herbal supplements!!!
- Phosphate Binders
  - Calcium-Based
  - Iron-Based
  - Aluminum-Based
  - Aluminum-Free
  - Magnesium-Based
- B-12/Folic Acid
  - MCV > 100 ng/mL
  - Serum levels < normal
- Vitamin D
  - Serum 25-hydroxy < 30 ng/mL (75 nmol/L)—ergocalciferol or cholecalciferol
  - iPTH > 600 pg/mL—Calcitriol
- Iron
  - Serum ferritin < 100 ng/mL
  - TSAT < 20%

HEMODIALYSIS

- In-Center vs Home
- 3 days/week vs 5 days/week
- 3-4 hour sessions
- Increased variation in fluid shifts
- Typically more restrictive diet
- Increased protein needs

PERITONEAL DIALYSIS

- At home, usually while sleeping (cyclic) or ambulatory
- Daily
- 9-10 hour sessions
- Less variations in fluid retention
- Dextrose can cause unwanted weight gain
- Diet usually more liberal than HD
- Increased infection risk
- Increased protein needs
- Changes in appetite
EXERCISE RECOMMENDATIONS

- Diabetic vascular disease
- Minimizes catabolic effects of protein restrictions in CKD
- #1 cause of death in dialysis and transplant patients is CVD
- Increased risk of frailty in chronic illness and aging
- American Heart Association Recommendations
  - 150 min/week cardiovascular
  - 2 days/week strength building

TRANSPLANT OPTIONS FOR DIABETICS

- Pancreas
- Islet Cell
- Simultaneous Pancreas Kidney
- Kidney

UW TRANSPLANT WAITING TIMES

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Figure 7.1 Percentage of dialysis patients wait-listed and unadjusted kidney transplant rates, 1997-2014

Data Source: Reference Tables E4 and E9. Percentage of dialysis patients on the kidney waiting list is for all dialysis patients. Unadjusted transplant rates are for all dialysis patients. Abbreviations: Tx, transplant; pt yrs, patient years.

Nutrition Considerations Pre-Transplant
- BMI
  - Pancreas < 30 kg/m²
  - SPK < 30 kg/m²
  - Kidney < 35 kg/m²
- Weight History
- Diet Restrictions
- Biochemical Data
- Activity level
- Frailty Assessments
- Contraindications: BMI > 30-35 kg/m², A1c >/= 10%

Frailty Assessment
- Fried, et al
  - Gait Speed: timed 4 meter walk
  - Grip Strength: hand dynamometer
  - Exhaustion: patient questionnaire
  - Physical Activity: Minnesota Leisure Activity
  - Weight change: within past year
NUTRITION CONCERNS FOLLOWING TRANSPLANT

- Hyperglycemia
- Hypophosphatemia
- Hyperkalemia
- GI upset
- Food Safety
- Hypertension
- Dyslipidemia
- Weight management

QUESTIONS & DISCUSSION

Thank you!

REFERENCES