What the Diabetes Team Needs to Know About ESRD

IHS Advancements in Diabetes

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Disclosure Statement of Dr. Andrew S. Narva

- I am a current member of the Nephrology Board.

- To protect the integrity of certification, ABIM enforces strict confidentiality and ownership of exam content.

- As a current member of the Nephrology Board, I agreed to keep exam information confidential.

- As is true for any ABIM candidate who has taken an exam for certification, I have signed the Pledge of Honesty in which I have agreed to keep ABIM exam content confidential.

No exam questions will be disclosed in my presentation.
Kidney Failure is an eGFR < 15

- Kidneys cannot maintain homeostasis.
- Kidney failure is associated with fluid, electrolyte, and hormonal imbalances and metabolic abnormalities.
- End-stage renal disease (ESRD) means patient is on dialysis or has a kidney transplant.
Incidence* of Diabetes-Related End-Stage Renal Disease (ESRD)

(Among Adults aged ≥18 years, by Race and Ethnicity — United States, 1996–2013)

Incidence* of diabetes-related end-stage renal disease among adults aged ≥18 years, by race and ethnicity — United States, 1996–2013

*Rate per 100,000 population and age-adjusted based on the 2000 US standard population. AI/AN=American Indians and Alaska Natives. Racial groups include persons of Hispanic and non-Hispanic origin; Hispanics may be of any race. Source: Data from the US Renal Data System and the US Census.
Coping with Kidney Disease and Failure is Challenging

- “I feel fine.”
  - The signs and symptoms may not be obvious until kidney disease is advanced.
- “Why me?”
  - Just like diabetes, acceptance of kidney disease takes time for most people.
  - Kidney disease may progress to kidney failure.
- Kidney “failure” or “end stage renal disease” sound scary.
  - Grief, fear and depression are not uncommon.
Most People are Not Prepared for Kidney Failure

- Discuss treatment choices early with progressive kidney disease.
- “Early” depends on the eGFR and the rate of decline.
- People who are not prepared and need treatment do not have much choice. They may start hemodialysis using a temporary vascular access (catheter).
- In 2011, more than 80% of people started hemodialysis with a temporary vascular access.
Key Issues in Managing Chronic Kidney Disease (CKD)

- Ensure the diagnosis is correct
- Implement appropriate therapy:
  - Monitor progression/Goals
  - Screen for CKD complications
- Educate the patient about CKD
- Prepare appropriately for kidney failure
AADE Practice Advisory Recommendations

1. Identify CKD due to diabetes and educate the patient about their kidney test results.
2. Slow progression of DKD: BP, Glucose control, diet
3. Collaborate with PCP to identify and monitor CKD complications.
4. Promote self-management.
   – Talk to patients about CKD
   – Communicate importance of testing
   – Explain progressive nature of CKD
   – **Begin to speak about dialysis and transplantation**

[AADE Practice Advisory Website](#)
Kidney Disease Education is a Medicare Benefit

- eGFR < 30
- Medicare B
  - Individual pays 20%, deductible applies
- Qualified providers: physicians, physician assistants, nurse practitioners, and clinical nurse specialists
- Up to six sessions covered
There are Three Choices for Treating Kidney Failure

1. Kidney transplant
   - From a living donor
   - From a deceased donor

2. Dialysis
   - Peritoneal dialysis (PD)
     - Continuous cyclic peritoneal dialysis (CCPD)
     - Continuous ambulatory peritoneal dialysis (CAPD)
   - Hemodialysis (HD)
     - In-center (dialysis unit)
     - Home

3. No transplant and no dialysis
A Kidney Transplant from a Living Donor May Be Better Than Other Treatments

Preparing for Kidney Treatment; You have a Choice
Kidney Transplant May Be a Choice for an Individual Who:

- Is healthy enough for surgery that can last up to 4 hours.
- Finds a living donor or gets on the National Kidney Registry (transplant list) for a deceased donor kidney.
- Is willing to take anti-rejection medications every day for the rest of their life.

Preparing for Kidney Treatment; You have a Choice
Peritoneal Dialysis May Be a Choice for an Individual Who:

- Has no contraindicating abdominal pathology.
- Wants to do their own treatments at home.
- Is willing to do treatments every day.
- Has room to store supplies at home.

Preparing for Kidney Treatment; You Have a Choice
In-center Hemodialysis May Be a Choice for an Individual Who:

- Can travel to a dialysis center 3 times a week for scheduled treatments.
- Prefers trained staff to handle their treatments.
- Does not mind needle sticks.
- Is willing to follow a diet that includes numerous restrictions.
Home Hemodialysis May Be a Choice for an Individual Who:

- Wants to do their treatments at home.
- Has someone who is willing to be trained to help them with treatments at home.
- Is willing to do treatments most days of the week.
- Has room for the machine and to store the supplies.
- Does not mind needle sticks and self-cannulation.

Preparing for Kidney Treatment; You Have a Choice
No Treatment and No Dialysis May be the Choice for an Individual Who:

- Feels treatment will not improve their health.
- Feels they have done what they wanted to do in life.
- Has family and friends who are in support of this decision.
Transplantation Option
The New Kidney is Placed in the Groin
Kidney Transplant: Pros and Cons

**PROS**
- A transplanted kidney is a normal, functioning kidney.
- Fewer diet restrictions are needed.
- A successful transplant may mean a longer life.
- The recipient may have better quality of life.

**CONS**
- The waiting list is long for a deceased donor.
- Rejection is a possibility.
- Anti-rejection medications suppress the immune system.
- Medications and weight gain may make diabetes harder to control.
- New onset diabetes after transplant is a possibility.
Anti-Rejection Medications Should be Taken as Directed (List 1)

<table>
<thead>
<tr>
<th>Prednisone</th>
<th>Azathiopine</th>
<th>Mycophenolate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight gain</td>
<td>Stomach upset</td>
<td>Decreased blood counts</td>
</tr>
<tr>
<td>Hyperglycemia</td>
<td>Muscle pain</td>
<td>Diarrhea</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td>Upset stomach</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoporosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor wound healing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High doses may be prescribed right after the</td>
<td>Take once or twice a day after meals,</td>
<td>Take on a regular schedule 1</td>
</tr>
<tr>
<td>transplant occurs; dose may be reduced over</td>
<td>about the same time every day.</td>
<td>hour before or 2 hours after</td>
</tr>
<tr>
<td>time.</td>
<td></td>
<td>eating or drinking, about 12 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>apart.</td>
</tr>
</tbody>
</table>

Stomach upset
Muscle pain

Decreased blood counts
Diarrhea
Upset stomach

Take once or twice a day after meals, about the same time every day.

Take on a regular schedule 1 hour before or 2 hours after eating or drinking, about 12 hours apart.
Anti-rejection Medications Should be Taken as Directed (List 2)

<table>
<thead>
<tr>
<th>Cyclosporine</th>
<th>Tacrolimus</th>
<th>Sirolimus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>Hyperglycemia</td>
<td>Swelling</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>Hypertension</td>
<td>Hyperlipidemia</td>
</tr>
<tr>
<td>Tremors, headaches</td>
<td>Tremors, headaches</td>
<td>Poor wound healing</td>
</tr>
<tr>
<td>Excess gum growth</td>
<td>Diarrhea</td>
<td>Proteinuria</td>
</tr>
<tr>
<td>Excess hair growth</td>
<td>Hair loss</td>
<td></td>
</tr>
<tr>
<td>Hyperkalemia</td>
<td>Trouble sleeping</td>
<td></td>
</tr>
<tr>
<td>Kidney toxicity</td>
<td>Hyperkalemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypophosphatemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kidney toxicity</td>
<td></td>
</tr>
</tbody>
</table>

- Take on a regular schedule at the same time each day.
- Do not eat grapefruit or drink grapefruit juice.

- Take on an empty stomach and regular schedule daily.
- Do not eat grapefruit or drink grapefruit juice.

- Take once a day, take it the same way, with or without food.
- Do not take with grapefruit juice.
The Risk Factors for New Onset Diabetes after a Kidney Transplant Include:

- Older age
- Ethnicity
  - African Americans and Hispanics > Whites
- Family history of diabetes
- Weight
- Positive Hepatitis C
- Immunosuppressant medication
  - Corticosteroids (prednisone)
  - Tacrolimus > cyclosporine
Peritoneal Dialysis
In Peritoneal Dialysis, the Peritoneum is the Substitute Kidney or “Filter”
What is a PD “Exchange”?  

- Dialysis solution with dextrose flows into the abdominal cavity.
- The solution remains for a prescribed time period, also known as the dwell time.
- Substances and fluid pass from the capillaries in the peritoneum into the solution.
- Dextrose enters the blood; and substances and fluid enter the solution.
- The solution is drained at the end of the dwell.
This is What an Exchange Looks Like:
In Continuous Cycling Peritoneal Dialysis (CCPD), a Machine Performs 3–5 Exchanges During Sleep
PD Dextrose Solutions are a Source of Carbohydrate

- The dextrose concentrations vary:
  - 1.25%, 2.5%, 4.25%
- The size of the bags vary:
  - 2-liter, 2.5-liter, 3-liter
- In CAPD, 60–70% is absorbed. The amount is higher due to longer dwell times.
- In CCPD, 40–50% is absorbed.
- Insulin requirements may increase.

Reference: McCann, 2009
Intra-peritoneal Insulin May be an Option

- Insulin may be injected into the bags of PD solution.
- The required dose may double or triple.
- Some insulin adheres to the bag and tubing.
- Lipids may be harder to control.

Diabetes, Obesity and Metabolism, 2008
Peritoneal Dialysis: Pros and Cons

**PROS**
- PD preserves residual renal function better.
- They do it on their own.
- They choose the time and place.
- They do not travel to a unit.
- Toxins are removed daily.
- The diet is not as restricted as hemodialysis.

**CONS**
- They must plan treatments around their activities.
- They need to adhere to the prescription for adequate treatment.
- They must follow instructions to keep the risk of infection low.
- They need to take supplies when traveling.
- They generally gain weight.
- Diabetes may be harder to control due to the carbohydrate in the dialysate.
Peritoneal Dialysis and Diet

- The diet may not be as strict as the diet for hemodialysis.
- The wastes products are removed daily.
- Amino acids lost during the exchanges must be replaced; dietary protein needs are higher.
- Absorbed dextrose calories may add weight.
- People with diabetes are never really “fasting.”
Nutrition Prescription: Peritoneal Dialysis

- Protein: 1.2–1.3 g/kg
- Calories: 30–35 kcal/kg
  - Includes calories from dextrose solutions
- Sodium: 2,000–4,000 mg
- Potassium: 3,000–4,000 mg
  - Still need binders
- Phosphorus: 800–1,000 mg
  - Fluid restriction–as needed

Reference: Shiro-Harvey, 2002
Hemodialysis
Hemodialysis (HD) Requires Vascular Access

- A temporary access is the least desirable type.
- A permanent vascular access is required.
  - This access is usually placed in the non-dominant arm.
- Protects blood vessels in both arms!
  - Avoid venipuncture and IV catheter placement above the wrist.
Most People Start Hemodialysis with a Temporary Vascular Access

- No needles are used.
- Blood flow rates are lower.
- They will need additional surgery to place permanent access.

Catheter for temporary access
An AV Fistula is the Preferred Access

- An artery is surgically connected to a vein.
- This type of access takes time to mature and cannot be used immediately.
- A fistula is less likely to clot.
Healthy People 2020 Objectives: Improve Vascular Access for Adult HD Patients

- Increase the proportion of patients who use arteriovenous fistulas as the primary mode of vascular access.
- Reduce the proportion of patients who use catheters as the only mode of vascular access.
- Increase the proportion of patients who use arteriovenous fistulas or have a maturing fistula as the primary mode of vascular access at the start of renal replacement therapy.
- Educate the patients early in the course of the disease so they will be ready for treatment.

Heathy Objectives to Improve Vascular Access
An AV Graft Will Work for Hemodialysis

- A synthetic tube connects the artery and vein.
- The graft takes less time to mature compared to a fistula.
- A graft is more likely to become infected or clot.
The Dialyzer is the Artificial Kidney in Hemodialysis

- Removal is based on size.
- Some nutrients are removed:
  - Glucose
  - Amino acids
  - Water-soluble vitamins
- Protein-bound substances, including many medications, are not efficiently removed.

Hemodialysis

Diagram:
- Dialyzer inflow pressure monitor
- Venous pressure monitor
- Air trap and air detector
- Air detector clamp
- Dialyzed blood returned to body
- Blood removed for dialysis
- Blood pump
- Arterial Pressure monitor
- Heparin pump (to prevent clotting)
Home Hemodialysis Requires Training and Support

- Conventional home hemodialysis (most common)
  - Three times per week

- Daily home hemodialysis
  - 2–3 hours, 5–6 days per week

- Nocturnal hemodialysis
  - 6–8 hours, 3 or more days per week

Home Dialysis Information
In-Center Hemodialysis: Pros and Cons

**PROS**
- Some people prefer the social setting.
- Facilities are found nationwide.
- Staff does the work:
  - Place and remove the needles
  - Monitor treatment
  - Maintain the equipment

**CONS**
- The diet is very strict.
- They have to follow a schedule.
- They must travel to the unit.
- They may take more medications.
- They may feel fatigued.
- Some nutrients are removed during treatment.
Home Hemodialysis: Pros and Cons

PROS

- Diet is less restrictive with more frequent treatments.
- They decide the time schedule.
- No travel to the unit is needed.
- The newer machines are small.
- Fewer ups and downs occur.

CONS

- They must have a partner.
- Partner burn-out is a possibility.
- They need space for treatment: machine, supplies, access to water and drainage, and electricity.
- They insert the needles.
- They need time off from work for initial training.
- Training is not offered everywhere.
A1c In Dialysis Patients

- A1c is affected by red cell survival
- In dialysis patients increased red cell turnover gives falsely low results
- Carbamylated hemoglobin is formed in uremic patients and can result in false elevations in the A1c
No Transplant and No Dialysis

- This is usually described as supportive care.
- The complications can be treated.
- Medications are still continued.
- The goal is to maintain quality of life.
- Encourage the patient to include family in decision making.
Summary: Treatment Choices

Discuss the choices early to allow time for the patient to adjust and make a decision.

1. Transplant requires daily immunosuppressant medications.
2. Dextrose solutions used in peritoneal dialysis contribute to carbohydrate load. Insulin requirements increase.
3. Hemodialysis has the most restrictive diet.
Questions & Comments

Email Dr. Andrew Narva:

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All materials available at:

http://nkdep.nih.gov/