Renal Decompensation: stages 1-4
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Renal Medicine Associates
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Nephrology NP Role:
- OP and IP
- CKD clinic
- Research
- Dialysis: In-center HD, Nocturnal
- Home Dialysis: HHD, PD, Nocturnal
- Education: Patient & annual Nephrology symposium

3rd Annual Nephrology Nursing Symposium

3rd Annual Nephrology Nursing Symposium
January 29, 2012
Albuquerque, NM
Objectives

- Recognize 6 possible complications of CKD (chronic kidney disease) and discuss how to intervene: how to prevent complications, how to treat the disease or complications or when to refer for appropriate treatment.
- Understand and initiate appropriate post-hospital care for the CKD patient.
- Care will be tailored for the stage 1-4 CKD patient.
- Speaker has no financial disclosures.

Chronic Kidney Disease Facts

- 26 million Americans have CKD.
- Early detection can help prevent the progression of kidney disease to kidney failure.
- Heart disease is the major cause of death for all people with CKD.
- Glomerular Filtration Rate (GFR) is the best estimate of kidney function.
- One out of 9 people will develop CKD.

- Hypertension cause CKD and CKD causes hypertension.
- Persistent proteinuria means CKD is present.
- African Americans, Hispanics, Pacific Islanders, Native Americans & Seniors are all high risk for CKD.
- 3 simple CKD checks:
CKD Stages from NKF Kidney Disease Outcomes Quality Initiatives (KDOQI):

- **Defining CKD** (Guidelines 1 and 6):
  - Kidney damage, as defined by structural or functional abnormalities of the kidney with or without decreased GFR
  - Hypertension
  - Proteinuria
  - Anemia
  - Diabetes
  - Hyperlipidemia
  - Obstructive uropathy/neurogenic bladder
  - Kidney Killers

- **Stages of CKD**:
  - Stage 1: GFR > 60 ml/min/1.73 m²
  - Stage 2: GFR 30-60 ml/min/1.73 m²
  - Stage 3a: GFR 15-29 ml/min/1.73 m²
  - Stage 3b: GFR 15-29 ml/min/1.73 m²
  - Stage 4: GFR 15-29 ml/min/1.73 m²
  - Stage 5: GFR < 15 ml/min/1.73 m²

- **Stages of CKD 5**:
  - Stage 5A: GFR 15-29 ml/min/1.73 m²
  - Stage 5B: GFR 15-29 ml/min/1.73 m²
  - Stage 5C: GFR < 15 ml/min/1.73 m²

- **What is GFR?**
  - Volume of urine filtered from the renal glomerular capillary into Bowman’s Capsule per minute.

Avoiding complications:
- Hypertension management
- Proteinuria management
- Anemia management
- Diabetes management
- Hyperlipidemia management
- Obstructive uropathy/neurogenic bladder management
- Prevention/management of UTIs/Pyelonephritis
- Bone Mineral Disease management of CKD
- Polypharmacy/renal dosing
- The emotional impact of a chronic disease
- Electrolyte (hyperkalemia) & edema management
- Kidney Killers
- Renal Replacement Therapy Planning
Hypertension

Goal? 120/70-130/80 -- JNC-7 guidelines:

<table>
<thead>
<tr>
<th>BP Classification</th>
<th>SBP</th>
<th>DBP</th>
<th>Lifestyle Modifications</th>
<th>Initial Drug Therapy with no co-morbidities</th>
<th>Initial drug therapy with co-morbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
<td>encourage</td>
<td>None</td>
<td>CKD, ACE/ARB</td>
</tr>
<tr>
<td>Pre-Hypertension</td>
<td>120-139</td>
<td>&gt;80</td>
<td>yes</td>
<td>None</td>
<td>CKD, ACE/ARB</td>
</tr>
<tr>
<td>Stage 1 Pre-Hypertension</td>
<td>130-159</td>
<td>&gt;90</td>
<td>yes</td>
<td>Thiazides for most. Must consider ACE, ARB, BB, CCB or combination</td>
<td>Treat co-morbidities. Others: ACE, ARB, BB, CCB</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>&gt;160</td>
<td>&gt;100</td>
<td>yes</td>
<td>2-Drug combination for most (usually thiazide with ACE, ARB, BB, CCB)</td>
<td>Treat co-morbidities. Others: ACE, ARB, BB, CCB</td>
</tr>
</tbody>
</table>

BP effects from lifestyle interventions:

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comments</th>
<th>Reduction in SBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet</td>
<td>Adopting DASH (Dietary Approach to Stop Hypertension) diet - rich in fiber, fruits, vegetables &amp; low in fat &amp; salt.</td>
<td>0-4 mmHg DASH diet not recommended by KDOQI if GFR &lt;60 mLs.</td>
</tr>
<tr>
<td>Weight Loss</td>
<td>Losing as little as 4 Kg or maintaining a BMI between 20-25.</td>
<td>3-20 mmHg (depends on amount of weight loss)</td>
</tr>
<tr>
<td>Regular Exercise</td>
<td>30-60 minutes of moderate intensity exercise 4-7 days/week in addition to daily activities.</td>
<td>4-9 mmHg</td>
</tr>
<tr>
<td>Restricting Sodium</td>
<td>Limiting total sodium consumption to &lt;2000 mg per day. New AHA guidelines recommends lowering sodium to 1000mg per day.</td>
<td>2-4 mmHg (sodium sensitive patients have significantly improved BP with decreased salt intake)</td>
</tr>
<tr>
<td>Reducing Alcohol Consumption</td>
<td>Taking &lt;2 drinks per week</td>
<td>2-4 mmHg</td>
</tr>
</tbody>
</table>

Tailoring the antihypertensive drug therapy to the co-morbidities (JNC-8 expected out in Summer 2012)

<table>
<thead>
<tr>
<th>Co-morbidity</th>
<th>First-Line Agents</th>
<th>Alternate Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Failure</td>
<td>Diuretics (thiazides not effective in GFR &lt;30 mLs), ACE, BB</td>
<td>ARB, Aldosterone antagonist</td>
</tr>
<tr>
<td>Post-MI</td>
<td>BB</td>
<td>ACE, Aldosterone Antagonist</td>
</tr>
<tr>
<td>DM</td>
<td>ACE</td>
<td>Diuretics, CCB, BB, ARB</td>
</tr>
<tr>
<td>CKD</td>
<td>ACE, ARB, RAAS blockers, DRI, Aldosterone antagonist</td>
<td>Non-Dihydropyridine CCB (Diltiazem &amp; Verapamil), BB</td>
</tr>
<tr>
<td>Recurrent Stroke</td>
<td>Diuretics (thiazides not effective in GFR &lt;30 mLs), ACE</td>
<td>BB, CCB, ARB</td>
</tr>
</tbody>
</table>
**RAAS Blockade**

- Sympathetic Stimulation
- Hypertension
- Decreased Sodium Delivery

**What are the differences RAAS Blocking drugs?**

**Pregnancy?**
- All Category C for 1st trimester & Category D for 2nd & 3rd trimester

<table>
<thead>
<tr>
<th>Better BP Control</th>
<th>Better Proteinuria Management</th>
<th>Results in less hyperkalemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARB</td>
<td>ACEi</td>
<td>ARB</td>
</tr>
</tbody>
</table>

- Results in higher creatinine levels? All equal
- Best patient tolerance? ARB or DRI
- Slight increase in cancer risk with ARB
- Least expensive ACE
- Best aldosterone reduction? ACEi or Aldosterone Blockers

**NKF, KDOQI Guidelines,**

- Increase in serum creatinine or 25%-30% over baseline levels when a patient starts an ACE

- ACEI/ARB effects on Serum Creatinine
- Check BNP in 1-2 weeks after starting medication to evaluate eGFR and potassium levels
- Treat the patient, not the serum creatinine.
Sick Day Patient Education for RAAS blockers:

- Avoid all NSAIDs – including OTC cold medications
- Stay well hydrated - stop all diuretics and RAAS blockers - monitor BP
- Use meds to manage nausea, vomiting & diarrhea. Avoid high sodium foods.

Take Home Points

- Get to target – make sure patient understands what is his target.
- Maximize ACE/ARB as first line therapy for CKD.
- Empower patient to check his BP and return for followup when BP is trending up (SBP >140).
- Utilize community resources – telemonitoring services for BP control through HHC.
- Avoid all RAAS drugs in sexually active women unless on birth control and the patient understands and agrees to the risks.

Proteinuria management

- [Image of proteinuria management]
What does proteinuria mean?

- The 3 main reasons for proteinuria:
  - Glomerular Disease (Diabetic nephropathy);
  - Overflow proteinuria (excessive serum protein); Low reabsorption at the proximal tubule (fanconi).
- Proteinuria is a risk factor (biomarker) for cardiovascular and kidney disease.
- Helps predict end organ damage.

Urine for albumin-creatinine ratio (UACR) is more sensitive than PCR for checking low levels of proteinuria.

UACR is the ADA recommended method for screening diabetics.

Transient proteinuria can be due to strenuous exercise, fever, UTI, vaginal mucous or pregnancy.

Case Study of Proteinuria Management:

- 51 y/o female with lupus nephritis. Very stable CKD stage 3. Follows rheumatology for her lupus----managed with plaquenil 200mg bid, prednisone 5mg qd and imuran 50mg qd. No lupus flares.

<table>
<thead>
<tr>
<th>Year</th>
<th>eGFR</th>
<th>UACR</th>
<th>Med/Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>1.36</td>
<td>Not checked</td>
<td>Monopril 40mg</td>
</tr>
<tr>
<td>2008</td>
<td>1.03</td>
<td>13.4</td>
<td>on ACE &amp; ? dose</td>
</tr>
<tr>
<td>2009</td>
<td>0.84</td>
<td>922.8</td>
<td>Lisinopril 5mg</td>
</tr>
<tr>
<td>2010</td>
<td>0.83</td>
<td>761.7</td>
<td>Lisinopril 20mg</td>
</tr>
<tr>
<td>2011</td>
<td>1.05</td>
<td>2162.5</td>
<td>Lisinopril 40mg</td>
</tr>
</tbody>
</table>
Take Home Points:

• Check UACR annually.
  www.kidney.org/apps - interactive clinical action plan that can be individualized for your patient.

• Adjust ACE/ARB to “manage” proteinuria.

• Refer to Nephrology if proteinuria is persistently present – even if CKD stage 1 or 2.

• Monitor potassium levels and educate patient on the risks of hyperkalemia and need for low potassium diet while on ACE/ARB.

Diabetes Management:

Diabetic Kidney Disease (DKD):

- 44% of all End Stage Renal Disease is caused by Diabetes
- Diabetes takes 15-25 years to progress to End Stage Renal Disease
- DKD is present with UACR >30mg/dl with or without eGFR decline.
- Aim for a HgA1c of < 7.00 gm/dl.
Work to achieve intensive diabetes management

- Medications
- Blood Glucose monitoring
- Meal planning
- Physical activity
- Protein modification

Patient Empowerment – resulting in no DKD – it is preventable.

Blood Glucose levels >180 cause glucosuria - which lead to DKD

Diabetic Case Study:
- 50 y/o female hospitalized in August for fatigue. Labs: sCr 2.96, Hg 9.4 (s/p transfusion), Albumin 1.8, potassium 5, HgA1c 7.5, UACR 6140, BP 153/94, weight 137#, started lisinopril 40mg qd.
- Monthly visits until started dialysis in Jan 2011.
- sCr range from 2.96- 6.40 (eGFR range 18-7 MLs) from Aug-Jan 2011. UACR 6140 – 8358 - 5317.
- Serum albumin 1.8- 2.2. Gained 30# of fluid during this time period. HgA1c 5.3.
Lab Data for Aug-Nov 2010

Updated analysis of Type 2 DM drugs of 166 studies comparing long-term outcomes of death, CV disease, DKD and neuropathy:

- **Metformin**—had the lowest side effect profile with a cost of 35 cents per pill.
- **Sulfonylureas** (Amaryl, Glucotrol, & Meglitinides) had highest risk for hypoglycemia.
- **TZDs** (Actos and Avandia)—increased risk of heart failure, weight gain & fractures.
- **DPP-4 inhibitors**—Januvia & Onglyza—Januvia cost $6.42 per pill.

No drug or drug combination had any advantage but long term outcomes not available on new medications.

Bennett, WL (2011). Updated analysis of Type 2 DM drugs. Annals of Internal Medicine

Renal Dosing

- Average CKD patient takes 7 different medications.
- CKD drug dosing is based on kidney function—using GFR. Usual formulations use MDRD or Cockcroft Gault.
- MDRD underestimates GFR at higher kidney function.

Bennett, WL (2011). Updated analysis of Type 2 DM drugs. Annals of Internal Medicine
**MDRD vs Cockroft Gault Calculation**

- **Cockcroft and Gault equation:**
  
  $CrCl = \left(\frac{(140 - \text{age}) \times \text{IBW}}{(\text{Scr} \times 72)}\right) \times 0.85 \text{ for females}$

  
  Note: if the ABW is less than the IBW use the actual body weight for calculating the Cr Cl.

**MDRD Formulation already calculated by the lab.**

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**Drugs that do not require renal dosing:**

- Metoprolol
- Propranolol
- Labetalol
- CCBs, ACE, ARBs, DRI
- Minoxidil
- Alpha Blockers
- Clonidine
- Glipizide
- TZDs
- Repaglinides
- Insulin may need tighter control
- Nitrates
- Amiodarone
- PPIs
- Tylenol
- Doxycycline
- Cloxacillin
- Macrolides
- Clindamycin
- Flagyl
- Psychotrophics: TCAs, SSRIs
- Fentanyl
- Morphine
- Hydrocodone
- Hydro-morphone
- Gabapentin
- Acyclovir
- Digoxin
- H2 Blockers - use 50% of dose with eGFR <50ML/s

Drugs that do not require renal dosing:

- No Sulfonylureas or Metformin when eGFR <60ML/s
- Glipizide is appropriate.

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**Drugs that do require renal dosing:**

- Hydralazine
- Benzothienylamides
- Nicotinic acid
- Non-steroidal Antinflammatory drugs
- Penicillin G
- Carbenicillin
- Imipenem/Cilastin
- Tetracyclines
- Nitrofurantoin
- Aminoglycosides
- Gentamicin
- Digoxin
- Acyclovir
- H2 Blockers - use 50% of dose with eGFR <50ML/s

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4/24/11
Patients with CKD may respond to drugs differently than patients with normal kidney function.

There is limited research on CKD Drug Absorption, GI transit time, stomach pH, GI tract edema, vomiting and diarrhea – which often adversely affect the absorption of drugs.

There is inconsistent findings if drug absorption is impaired with CKD.

CKD drug dosing pearls:

Tissue binding changes or body composition changes?

• Volume changes?

Changes in plasma protein binding abilities?

• Drug Calculation method!

Drug Distribution effect in CKD may be due to:

CKD Basic Pharmacology Principles:

• Is the drug excreted through the kidneys?
• Is there a chance of drug toxicity with increased drug levels?

• If the answer to both questions is yes – then decreased renal clearance could result in toxic drug accumulation.

• Medication necessity must be carefully assessed.
• Prescribe the drug with the least nephrotoxic side effect profile.
Special dosing for loading/maintenance medications–

**Loading Dose Guidelines**
- Medications needing a loading dose require no renal dose adjustment.

**Maintenance dosing can be adjusted in 2 ways:**
- Reduce each dose but maintain same dose interval – risks toxicity due to drug accumulation.
- Maintain same dose but lengthen dosing interval – risks sub-therapeutic dosing.

Use appropriate resources for prescribing: Epocrates, Sanford, on line resources, pharmacists, etc.

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**Take Home Points**
- Use resources for drug dosing.
- Use MDRD eGFR to help guide the customized dose for your patient.
- Avoid use of nephrotoxic drugs: NSAIDs, aminoglycosides, etc.

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**Urinary Tract Infections (UTIs) and Pyelonephritis**
Urinary Tract Infection Preventions

- Do not treat asymptomatic bacteriuria – increases antibiotic resistance
- Be alert for neurogenic bladders, enlarged prostates – can lead to obstructive uropathy

Urinary Tract Infection Prophylaxis

- History of multiple UTIs – consider ID and Urology consult for evaluation and possible need for antibiotic prophylaxis
- Behavior modifications: hydration, double void, cranberry tablets

Polycystic Kidneys

- Treat flank pain, hematuria as pyelonephritis – to prevent additional kidney scarring
- Obtain urinalysis and treat with ciprofloxacin with dosing per GFR.
- Adjust medication per urine culture results

IDSA Guidelines for diagnosis and treatment of asymptomatic bacteriuria in adults

- Screening for or treatment of asymptomatic bacteriuria is not recommended for the following:
  - Premenopausal or non-pregnant women
  - Diabetic women
  - Older women
  - Elderly living in institutions
  - Spinal Cord Injured
  - Patients with catheters – when catheter is left in situ
  - Patients with solid organ transplants
IDSA recommended treatment for acute pyelonephritis (2010)

- Urine for culture and sensitivity – tailor therapy to uropathogen.
- Nonhospitalized non-renal antibiotic dosing:
  - Ciprofloxacin 500mg bid for 7 days
  - Ciprofloxacin 1000mg ER qd for 7 days
  - Levofloxacin 750mg qd for 5 days
- Use fluoroquinolone in areas where uropathogen fluoroquinolone resistance is ≤ 10%.
  - Insufficient data re: what fluoroquinolone resistant level requires an alternative agent to replace a fluoroquinolone.

Other antibiotic options for pyelonephritis:

- If local fluoroquinolone resistant level is >10%, administer initial IV antibiotic with option of:
  - TMP/SMX DS bid for 14 days if uropathogen is susceptible.
- Oral β-lactam agents are less effective than other available agents for treatment of pyelonephritis – treat for 10-14 days. Oral B-lactam antibiotics include penicillin based medications and 1st, 2nd and 3rd generation cephalosporins.
Cochrane Review: UTI prevention

- Cranberries contain a substance that can prevent bacteria from sticking on the walls of the bladder.
- 10 studies (n=1049) reviewed comparing cranberry products with placebo, juice or water. There was some evidence to show that cranberries (capsules & juice) can prevent recurrent infections in women.
- Evidence less clear for UTI prevention is elderly men & women. Not effective in people who require catheterisation.
- It is not clear how long cranberry juice needs to be taken to be effective or what is the recommended cranberry dose.

Take Home Points

- Hydration.
- Verify patient is emptying their bladder.
- Check urinalysis only if patient is symptomatic of UTI.
- Use antibiotics appropriately for level of kidney function.
- Promote prevention techniques for patients with multiple UTIs – cranberry tablets, double voiding, possible help peri-urethral topical application of estrogen cream for women.

Hyperkalemia: Normal Range 3.5-5.0 mEq/L

Over 5.0 mEq/L is considered hyperkalemia.
Evaluate the cause of Hyperkalemia --

Medications:
KCL, NSAIDs, ACEi, ARBs, Cyclosporine, Heparin, Pentoxifylline, Tocilizumab, K-sparing diuretics, Trimethaphan, Digoxin.

HERBS:
Alfalfa, dandelion, and noni juice contain potassium- a contraindication with CKD.

Diet:
No Salt Substitutes. Avoid potassium in the diet.

“Your body does not make it – you have to eat, drink or take a medicine that increases potassium”

No bananas or orange juice, no avocados or yogurt, leached potatoes only restricted milk products – potassium restriction is difficult, avoid anything that says salt in the label. Use Mrs. Dash, herbs or pepper.

USRDS Food Chart

Treatment of low level (5-5.5mEq/L) of Hyperkalemia:

Evaluate medications and eliminate possible offenders
Give furosemide 40-80mg po
Diet Counseling

Evaluate diet and discuss adverse effect of high potassium
Give Kayexelate 15gm po – powder does not cause diarrhea.

Recheck Lab in 1-2 weeks
Treatment of moderate Hyperkalemia (5.6 – 6.4 mEq/L):

- Check EKG – if changes – send to ER for treatment.
- If no EKG changes: Kayexelate, furosemide and diet consult.
- Consider stopping ACE/ARB. Discuss with Renal if Renal patient. Evaluate meds, diet and re-check labs. If this is a chronic problem – renal consult.

Treatment of severe Hyperkalemia: (> 6.5 mEq/L) -- ER visit

- Calcium Gluconate 10mLs – 10% over 2-5 minutes
- Albuterol Nebs 10-20mg over 15 minutes
- Bicarbonate 50 mEq IV over 5 minutes if acidic
- 10 units of Regular Insulin & D50 Ampule IV
- Kayexelate 15-30mg dose & Furosemide 40-80 mg IV or double home dose
- Consider urgent hemodialysis

CABIGFKD – diet counseling, stop RAAS blocker & re-check lab.

Hyperkalemia is an evolving cardiotoxicity:

- Less ECG changes in patients with advanced CKD
Take Home Points

- When prescribing any medications that may increase potassium to CKD patients, discuss restricting potassium in their diet at the same visit.
- Consider re-checking lab in 1-2 weeks after starting medication.
- Inform patients that generally they have no symptoms of hyperkalemia.

If your CKD patient is admitted to the hospital and then scheduled to see you as follow-up.....

Post Hospital Pre-Patient Visit Planning:

- Review discharge summary
  - Clarify outstanding questions with discharging provider
- Visit reminder (labs, medications, CBGs, BP home monitoring)
- Coordinate other services (home care, case management, DME, supplies)
During Patient Visit – Plans & Goals

- Clarify the patient's goals for the visit.
- Ask the patient to tell you what they think triggered the hospitalization.
- Review all medications with patient & complete a medication reconciliation – give copy to patient.
- Establish a written plan for emergency & non-emergency care.


Your Plan:
- Adjust if needed any medications.
- Follow-up on any outstanding test results.
- Order new tests.
- Discuss advance directives and specific future treatments (POLST).
- Instruct on self-management, warning signs and emergency care – have patient "teach back".
- Communicate with the other involved providers.
- Arrange next visit.

- Was Patient take off RAAS blockade – if so why & what is plan?
- Did the Patient follow the Sick Day plan for RAAS blockade – did that cause a problem?
- If Patient had AKI – arrange renal consult or renal follow-up.
- Verify Proteinuria, DM and BP control.
- Are the new medications renal dosed?

Specific CKD hospital follow-up…
Review Kidney Killers

When to refer to Nephrology?
- Resistant hypertension
- Persistent proteinuria, hematuria or abnormal imagining studies
- Stage 3 or more advanced CKD
- Acute Kidney Injury
- Patient has known ADPKD or other known anatomical abnormality
- Past renal transplant

Thank you
- Email: beth@renalmed.com