Chronic kidney disease: The role of the Pharmacist

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Kidney Foundation of Guyana (KFG)
Caribbean Association of Pharmacists Annual Convention
Guyana Marriott Hotel
13th August 2015
Outline

- Statistics
- Definition of Chronic renal failure
- Staging
- Co morbidities
- Clinical manifestations
- Investigations
- Management
- Role of the pharmacist in detecting and managing CRF
- Conclusion
Statistics

- Prevalence of CKD (stage 1-5) is 16.8% in USA

- The US Renal Data System estimates that by 2020, more than 700,000 Americans will have ESRD, with more than 500,000 requiring dialysis and more than 250,000 receiving a transplant.

- In Guyana the incidence of diabetes is 1.5% and the prevalence is 5.2%.

- The incidence of hypertension is 2% and the prevalence is 7.6%.

How important are our kidneys?

- Two 4-oz organs with excretory, biosynthetic, and metabolic functions.

- Process about 50 gallons of blood daily, removing waste products and excess water.

- Essential for erythropoietin synthesis, which stimulates red blood cell production.

Jeannette Y. Wick, R., Chronic Kidney Disease: Pharmacist Intervention Can Improve Quality of Life. Pharmacy times, February 9, 2011
How important are our kidneys?

- Metabolize 25-hydroxy-vitamin D to active 1,25-dihydroxy-vitamin D (calcitriol); this regulates calcium absorption and bone formation.

- Their effect on rennin regulates blood volume and blood pressure.

- Should both kidneys fail, dialysis can replace some of their excretory functions, but the biosynthetic and metabolic activities are irreplaceable.

Jeannette Y. Wick, R. Chronic Kidney Disease: Pharmacist Intervention Can Improve Quality of Life. Pharmacy times. February 9, 2011
What is chronic kidney disease (CKD)

Kidney damage (structural or functional) or glomerular filtration rate (GFR) <60 mL/min/1.73 m2 for 3 months or more, irrespective of cause.

Kidney damage in many kidney diseases can be ascertained by the presence of albuminuria, defined as albumin-to-creatinine ratio >30 mg/g in two of three spot urine specimens.
CKD and end-stage renal disease (ESRD) are associated with
- increased risk of mortality
- increased rate of hospitalization
- decreased life expectancy

Progression from early to late stages of CKD generally results in the onset of new symptoms and concomitant complications.
## Risk factors

<table>
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<th>Risk factors</th>
<th>Definition</th>
<th>Examples</th>
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<tr>
<td>Susceptibility factors</td>
<td>Increase susceptibility to kidney damage</td>
<td>Old age, family hx of CKD, low income or education status</td>
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<tr>
<td>Initiation factors</td>
<td>Directly initiate kidney damage</td>
<td>Diabetes, hypertension, autoimmune disease, systemic infections, drug toxicity</td>
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</table>
Causes of Chronic Kidney Disease

- Type 2 diabetes: 42%
- High blood pressure: 28%
- Glomerular diseases: 6%
- Miscellaneous: 4%
- Unknown: 4%
- Type 1 diabetes: 3%
- Cystic/Hereditary: 3%
- Nephritis: 3%
- Tumors: 3%
# Stages of Chronic Kidney Disease and Recommended Clinical Action

<table>
<thead>
<tr>
<th>Stage/Description</th>
<th>GFR (mL/min/1.73 m²)</th>
<th>Action*</th>
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<tr>
<td>At increased risk</td>
<td>&gt; 90 with CKD risk factors</td>
<td>Screening CKD risk reduction</td>
</tr>
<tr>
<td>1 Kidney damage with normal or ↑ GFR</td>
<td>≥ 90</td>
<td>Diagnosis and treatment Treatment of comorbid conditions Slowing progression CVD risk reduction</td>
</tr>
<tr>
<td>2 Kidney damage with Mild ↓ GFR</td>
<td>60–89</td>
<td>Estimating progression</td>
</tr>
<tr>
<td>3 Moderate ↓ GFR</td>
<td>30–59</td>
<td>Evaluating and treating complications</td>
</tr>
<tr>
<td>4 Severe ↓ GFR</td>
<td>15–29</td>
<td>Preparation for kidney replacement therapy</td>
</tr>
<tr>
<td>5 Kidney failure</td>
<td>&lt; 15 or dialysis</td>
<td>Replacement, if uremia present</td>
</tr>
</tbody>
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GFR, glomerular filtration rate; CKD, chronic kidney disease; CVD, cardiovascular disease.
*Includes actions from preceding stages.

CKD is usually silent until its late stages

Without aggressive screening, it may escape detection until immediately before symptomatic kidney failure develops.

Unimpeded, CKD’s terminal complication—ESRD—ends any opportunity to prevent kidney function decline or improve quality of life.
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<th>Co morbidities</th>
<th>Sequeiae</th>
<th>Management</th>
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<tr>
<td>Traditional cardiovascular</td>
<td>Arrythmia</td>
<td>Salt and fat restriction</td>
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<tr>
<td>Hypertension</td>
<td>Vavlular heart disease</td>
<td>Exercise</td>
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<tr>
<td>Dyslipdemia</td>
<td>Ischemic heart disease</td>
<td>Stop smoking</td>
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<tr>
<td>Obesity</td>
<td>LVH</td>
<td>Statins</td>
</tr>
<tr>
<td>Impaired glucose tolerance</td>
<td></td>
<td>Diuretics</td>
</tr>
<tr>
<td>Sedentary lifestyle</td>
<td></td>
<td>Folic acid</td>
</tr>
<tr>
<td>Tobacco use</td>
<td></td>
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<tr>
<td>Metabolic</td>
<td>Arrhythmias</td>
<td>Potassium supplementation with loop diuretics</td>
</tr>
<tr>
<td>Hypokalemia and hyperkalemia</td>
<td></td>
<td>Avoid potassium, ARB, ACE inhibitors and NSAIDS.</td>
</tr>
<tr>
<td>Hyponatremia</td>
<td></td>
<td>Low phosphorus diet, Phosphate binders</td>
</tr>
<tr>
<td>Hyperphosphatemia</td>
<td></td>
<td>Calcium carbonate</td>
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<tr>
<td>Hypocalcemia</td>
<td></td>
<td>Vitamin D therapy</td>
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<tr>
<td>Impaired Vit D synthesis</td>
<td></td>
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<tr>
<td>Acidosis</td>
<td>Poor growth</td>
<td></td>
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<tr>
<td>Co morbidities</td>
<td>Sequelae</td>
<td>Management</td>
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<td>----------------------------------------</td>
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<tr>
<td>Anemia</td>
<td>Fatigue</td>
<td>Iron supplementation</td>
</tr>
<tr>
<td>Erythropoietin deficiency</td>
<td>Impaired cognition</td>
<td>Vitamin B12 and Folic acid EPO</td>
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<tr>
<td>Chronic blood loss</td>
<td>Sleep disturbance</td>
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<tr>
<td>Malnutrition</td>
<td>Exercise intolerance</td>
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<tr>
<td>Iron deficiency</td>
<td></td>
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<tr>
<td>Bone marrow suppression</td>
<td></td>
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<tr>
<td>Decreased RBC survival</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Nutrition</td>
<td>Malnutrition</td>
<td>Sodium bicarbonate</td>
</tr>
<tr>
<td>Acidosis</td>
<td>Cachexia</td>
<td>Salt restriction</td>
</tr>
<tr>
<td>Anemia</td>
<td>Protein energy wasting</td>
<td>Protein intake 2.5g/kg/day</td>
</tr>
<tr>
<td>Anorexia</td>
<td></td>
<td>High biologic value protein (egg, milk,</td>
</tr>
<tr>
<td>Volume overload</td>
<td></td>
<td>meat, fish)</td>
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<tr>
<td>Endocrine disorders</td>
<td></td>
<td>Supplement carbohydrate, fat (MCT) and</td>
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<tr>
<td>Chronic inflammation</td>
<td></td>
<td>protein</td>
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<tr>
<td>Nausea and Vomiting</td>
<td></td>
<td>Nasogastric, gastrostomy, tube feeding</td>
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<tr>
<td>Impaired gastric emptying</td>
<td></td>
<td>Continuous overnight infusions</td>
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<tr>
<td>Nutrient loss during dialysis</td>
<td></td>
<td>Water soluble vitamins</td>
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<td>Co morbidities</td>
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<td>Management</td>
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<td>---------------------------------------------------</td>
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<tr>
<td>Growth</td>
<td>Decreased linear growth</td>
<td>Adequate calorie intake</td>
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<tr>
<td>Early onset CRD</td>
<td>Poor health related QOL</td>
<td>Early management of complications</td>
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<tr>
<td>Medications (steroids)</td>
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</tr>
<tr>
<td>Acidosis</td>
<td></td>
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<tr>
<td>Protein Calorie malnutrition</td>
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<tr>
<td>Reproductive</td>
<td>Infertility</td>
<td>Family planning</td>
</tr>
<tr>
<td>Impaired fertility</td>
<td>Fetal loss</td>
<td></td>
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<tr>
<td>Pregnancy related events</td>
<td>Teratogenic effects</td>
<td></td>
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<tr>
<td>Immunologic</td>
<td>Susceptibility to infections by common opportunistic organisms</td>
<td>Vaccination Prompt recognition and treatment of infections</td>
</tr>
<tr>
<td>Co morbidities</td>
<td>Sequelae</td>
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<td>--------------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
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<tr>
<td>Disease burden</td>
<td>Poor QOL</td>
<td>Support network</td>
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<tr>
<td>Number of meds</td>
<td>Depression</td>
<td>Counseling</td>
</tr>
<tr>
<td>Medication dosing / schedule</td>
<td>Family stress</td>
<td>Recognize and treat depression</td>
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<tr>
<td>Medication route</td>
<td>Financial burden</td>
<td></td>
</tr>
<tr>
<td>Medication adverse effect</td>
<td>Absent for work / school</td>
<td></td>
</tr>
<tr>
<td>Monitoring (BP, Urine, Sugar)</td>
<td>Marital discord</td>
<td></td>
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<tr>
<td>Dietary restriction</td>
<td></td>
<td></td>
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<tr>
<td>Need for dialysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
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</tbody>
</table>

- Support network
- Counseling
- Recognize and treat depression
Clinical manifestations

- Lethargy
- Anorexia
- Vomiting
- Growth failure / short stature
- Failure of thrive
- Pallor
- Edema
- Hypertension
- Hematuria
- Proteinuria
- Polyuria
- UTI
CHRONIC RENAL FAILURE (CRF) - RENAL INSUFFICIENCY -

- Headaches
- Edema
- ↓ Ability to Concentrate Urine
- GFR - progressively decreases from 90 to 30 ml/min
- Polyuria → Oliguria
- Mild Anemia
- ↑ BUN & Serum Creatinine
- ↑ BP
- Weakness & Fatigue
Physical Examination

- Pallor
- Short stature
- Bony abnormality of renal osteodystrophy
- Edema
- Hypertension
Investigations

- Elevated BUN and creatinine
- ↓ GFR
- Hyperkalemia
- Hyponatremia
- Acidosis
- Hypocalcemia
- Hyperphosphatemia
- Elevated uric acid

- Hypoproteinemia (if proteinuria)
- Normocytic, normochromic anemia
- Elevated serum cholesterol and triglyceride
- Hematuria & Proteinuria (glomerulonephritis)

GFR (ml/min /1.73m2) = k x height (cm) S. Creatinin (mg/dl) k= 0.33 LBW < 1 yr 0.45 term AGA < 1yr 0.55 children & adolescent female 0.70 adolescent male
Why do we care so much?

- Many CKD patients die from comorbidities before ESRD develops

- CKD is among the most costly of health care challenges

- Should dialysis be necessary, annual medical costs increase to a minimum of USD10,000 per patient.

- Transplant is more costly, with average medical costs of about USD$102,000 in the transplant year.

Why do we care so much?

- Identifying CKD patients early and preventing progression to ESRD may improve quality of life and save health care dollars.

- Aggressive screening is needed.

- Once patients are identified, several interventions are crucial.

- Managing comorbid disease states and maintaining kidney function become twin priorities for CKD patients and their health care team.
Role of the Multidisciplinary Team in CKD

Establish a Multidisciplinary Team Early

- Involve a renal dietitian and a pharmacist
- Refer to nephrology early
- Schedule general surgery for peritoneal catheter placement
- Schedule vascular surgery for permanent vascular access
What can we do?

A. Prevent or stop the progression of CKD
   1. Avoid nephrotoxins (stop all meds that can adversely affect the kidneys)
   2. Treat co morbid conditions
      ▶ A. Ensure tight glycemic control adjusting medications accordingly and avoid hypoglycemia, HbA1c <7% (reduced insulin excretion)
      ▶ B. Maintain BP within normal limits
      ▶ C. Manage dyslipidemias

What can we do?

3. Consider protein restriction
4. Start ACE inhibitors if indicated, monitor for deterioration in kidney function and hyperkalemia.

B. Treat the underlying cause
   ▶ Diabetes
   ▶ Hypertension

C. Plan for renal replacement therapy
Anticipate Chronic Renal Replacement Therapy

- Educate patients early and heavily about disease progression, potential dialysis modalities, renal transplantation, and the option to refuse or discontinue chronic dialysis

- Place permanent vascular access (arteriovenous fistula) at least 6 months before anticipated date of dialysis

- Arrange elective peritoneal dialysis catheter insertion
Anticipate Chronic Renal Replacement Therapy

- Refer for renal transplantation early
- Restrict diet appropriately to CKD progression
- Restrict protein as the patient progresses to ESRD to delay uremia onset
- Implement strategies to address or correct malnutrition

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How can Pharmacists help?

- Identify patients at risk for chronic kidney disease
  - Most patients visit the pharmacy for primary care
  - Pharmacists can intervene by doing RBS / FBS and BP
  - These are screening tests for the most common causes of CKD

- Screenings can be done at regular intervals; any abnormal findings should warrant a formal visit to the doctor.

- High risk patients can be followed regularly
Role of the pharmacist

- Once a patient is diagnosed with CKD:
  - The pharmacist can educate the patient about the importance of medication management, adherence to drug regimens, and the potential risks of nephrotoxic medications.
  - Continually assesses drug therapy for efficacy and adverse effects.

Role of the pharmacist

The main areas of focus for the CKD pharmacist are

- management of anemia
- monitoring for hypertension and DM
- reduction of cardiovascular risk
- adjustment of doses, and recommendations relating to medications that are eliminated renally.

Role of the pharmacist

▶ The pharmacist is ideally suited to provide a myriad of interventions that may improve the quality of care of patients with chronic kidney disease.

▶ This may occur early on to prevent or delay the onset of CRF in high-risk patients.

▶ Pharmacists can provide diabetic patient education and can work collaboratively with physicians by providing medication therapy management for both disease states.
Role of the pharmacist

- Medication review is critical for patients who have CKD.
- Patients need guidance because Stage 3 or 4 CKD patients usually have 6 to 8 medications in their drug regimens.
- With ESRD, pharmacists can expect to see 10 to 12 different medications.
- Pharmacists need to ensure that renally cleared drugs are adjusted as the kidneys fail.
- As new medications become necessary, patients will need help understanding their medication.

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Role of the pharmacist

- Careful therapeutic drug monitoring can prevent most interactions and adverse drug events.

- Some side effects are unavoidable, and the entire team needs to educate the patient about management techniques.

- Promoting adherence requires constant vigilance and encouragement.

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Role of the pharmacist

Anemia

- Pharmacists can play a role in improving the treatment of anemia
- Screening for anemia
- Developing guidelines for the use of anemia therapies
- Provide patient education to promote adherence to the treatment regimen.
Role of the pharmacist

- Favorable impact of clinical and economic outcomes has been demonstrated in pharmacist managed hypertension and diabetes clinics.

- Erythropoietin-stimulating agents (ESAs) are among the most costly drug therapies in the pharmacy budget at healthcare institutions.

- Efforts by pharmacists to develop and implement institutional protocols or guidelines for ESA use can have economic benefits as well as improve clinical outcomes.
Dialysis

- Besides acting as teachers, dialysis unit pharmacists also can help prevent medication errors and adverse drug reactions in patients.

- In addition, pharmacists can help patients maintain healthy hemoglobin levels, which, in the long run, also benefits hospitals.

- “It's almost a crime that pharmacists are not involved, given the adverse drug events that have occurred and the number of lives that can be saved by pharmacist involvement.”

M. Barbella. Hospital pharmacists are playing a more important role in the treatment of end-stage renal disease, Drug Topics. Oct 2007
Conclusion

- CKD and ESRD will become an even greater burden on the health care system in the near future.
- Aggressive screening and early intervention are needed to prevent many victims from progressing to dialysis or kidney transplants.
- Pharmacists should urge high-risk patients to be screened.
- Screening is increasingly easy, and often free.
- Pharmacists can start by educating their patients and the public about risk factors CKD, early detection and aggressive management to prevent ESRD.

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Conclusion

- Pharmacists can work to reduce the many complications and comorbidities of renal disease such as assisting patients with selection of appropriate supplements (iron).

- It is important for pharmacists to note any history of CKD, be aware of precipitating factors and co-morbid conditions associated with CKD, and advise patients and providers about drugs to avoid and recommend the necessary dosing adjustments in these patients.