Kidney Health, Kidney Disease & HIV
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Kidney Structure and Function
The Nephron

- • 150L/day
  - Total glomerular volume filtered 50-100 mL/day
  - With filtration occurring in the tubule
- Kidney function dependent on high rates of renal blood flow
- Vascular disease – diabetes and hypertension – The most common cause of kidney disease

- Measuring Kidney Function: GFR
  - Inulin
  - Iothalamate
  - Ioxsupaque
  - Estimating GFR: Cockcroft-Gault
  - MDRD and CKD-EPI equations

- Assessing for Kidney Damage
  - Urinary dipstick for protein
  - 24h urine for protein
  - Urine protein/creatinine ratio
  - Microalbumin assay

Chronic Kidney Disease (CKD)
Kidney damage or reduced kidney function lasting > three months

<table>
<thead>
<tr>
<th>CKD STAGE</th>
<th>Kidney Function</th>
<th>eGFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal</td>
<td>&gt;90</td>
</tr>
<tr>
<td>II</td>
<td>Mild decrease</td>
<td>60-89</td>
</tr>
<tr>
<td>III</td>
<td>Moderate decrease</td>
<td>30-59</td>
</tr>
<tr>
<td>IV</td>
<td>Severe decrease</td>
<td>15-29</td>
</tr>
<tr>
<td>V</td>
<td>Kidney failure</td>
<td>&lt;15 or dialysis</td>
</tr>
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Incidence, Prevalence and Risk factors for Kidney Disease in HIV

- Incidence # cases/100 patient years – often the metric used in large observational studies
- Prevalence: proportion of patients affected – often the metric used when described smaller cohorts, such as clinic population or in cross-sectional studies
- Chronic Kidney Disease prevalence 3-15%
- Acute renal failure (Acute Kidney Injury) prevalence ~5%
- Major kidney disease risk factors
  - Hypertension
  - Diabetes mellitus
  - African American race
  - Aging
  - HIV related risk factors
  - Hepatitis C virus infection
  - Decreased CD4 cell count
  - Increased viral load
- How much kidney disease in HIV is attributable to the antiretroviral regimen?

Diagnostic Approach to Kidney Disease

- Screen
  - Urinalysis, microalbumin assay, GFR estimated from serum creatinine
  - Extremes of body weight – amputee, cirrhosis, obesity, cachexia/muscle wasting, body builder
Diagnostic Approach to Kidney Disease

Once identified, assess likely underlying cause

• History and physical exam, supported by diagnostic laboratory testing
  – Is the kidney disease acute or chronic?
  – Assess for the presence of CKD risk factors.
    • Atherosclerosis: Diabetes, hypertension, dyslipidemia, CAD, aging
    • Are there other signs of target organ damage?
      – Retinopathy, PAD, LVH
    • Is the rate of change in GFR consistent with atherosclerosis/microvascular disease?
    • Renal imaging (sonogram) and urinalysis (protein, red cells, WBC, casts, crystals)

Screening for Kidney Disease in HIV

• Screen for kidney disease with a baseline urinalysis and creatinine clearance
  – Particularly in black patients because of the risk of HIVAN
  – Prior to initiating treatment with drugs such as tenofovir or indinavir, that have the potential for nephrotoxicity.

• Annual screening of high risk patients (black, CD4<200 cells, VL>4000, DM, HTN, HCV)

• Assess kidney function before initiation and during ART, in particular when tenofovir is used, allowing avoidance, dose modification, or timely substitution of another drug when appropriate

ART Exposure & CKD: EuroSIDA

DHHS Guidelines
Serum Creatinine:
Determined by creatinine generation, GFR and tubule secretion of creatinine

Goals of Care for Patients with Kidney Disease

- Early or borderline CKD
  - Identify its presence
  - Diagnose the underlying cause
  - Initiate therapies to prevent or delay the progression to ESRD
  - Initiate therapies that prevent or delay CV disease

- Later stages of kidney disease
  - Risk stratify for complications - particularly in hospitalized patients
  - Treat complications that stem directly from reduced-functioning renal mass
  - Avoid drug dosing errors

Summary

- Renal complications in HIV are relatively common.

- Many renal complications are potentially avoidable.

- Try to be proactive, rather than reactive, to protect the kidneys.