

## North American Pediatric Renal Trials and Collaborative Studies (NAPRTCS)

- Founded in 1992
- 78 participating centers in Canada & U.S.
- 16,339 CKD patients age 0 – 18 years
- 9,506 renal transplant patients
- 6,274 chronic dialysis patients

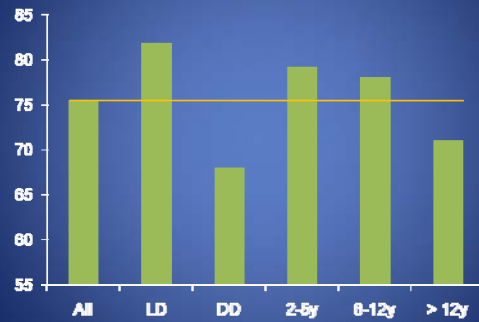
## Causes of CKD in Children

Obstructive uropathy	21%
Aplasia/hypoplasia/dysplasia	18%
Focal segmental glomerulosclerosis	9%
Reflux nephropathy	8%
Diabetic nephropathy	0.2%

## ESRD Mortality

Age at Treatment Initiation	Survival 3 Years Later If Dialysis	Survival 3 Years Later If Transplant
All patients	86%	97%
< 2 years	66%	92%
2-5 years	83%	96%
6-18 years	90%	98%

## 5-Year Allograft Survival

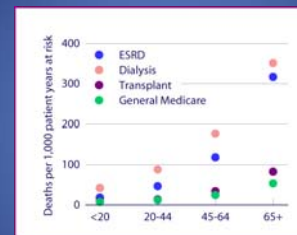


## Causes of 'Late' Graft Failure

Cause	%
<b>Rejection</b>	<b>56.6</b>
Recurrence of original kidney disease	8.8
Infection	2.4
Malignancy	1.5

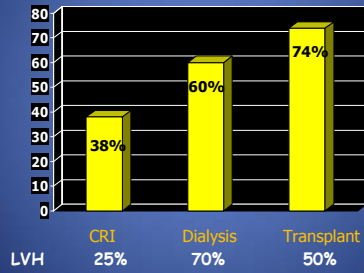
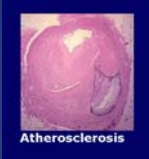
- Medication noncompliance is a leading cause of morbidity in adolescent transplant recipients; this group demonstrates the lowest level of compliance of any age group
- Fluctuating CNI levels are red flag for nonadherence
- "Compliance-friendly" regimens that involve fewer medications, doses and adverse effects

## All-cause mortality rates, 2005, by age



Cardiovascular disease is the predominant cause of death in patients with end-stage renal disease  
 2007 Annual Data Report - Atlas of End-Stage Renal Disease in the U.S.

## Prevalence of Hypertension/LVH in Children with CKD

**Atherosclerosis**

**Figure 8 - The Approach to Treatment of Dyslipidemias in Adolescents With Chronic Kidney Disease Used in These Guidelines**

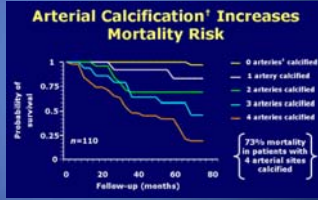
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    graph TD
      A{TG >= 500?} -- No --> B{LDL >= 130?}
      A -- Yes --> C[TLC]
      B -- No --> D{LDL 130-159?}
      B -- Yes --> E[TLC]
      D -- No --> F{LDL >= 160?}
      D -- Yes --> G[TLC + Statin]
      F -- No --> H{LDL >= 160?}
      F -- Yes --> G
      H -- No --> I[Continue to Monitor]
      H -- Yes --> J[Consider a Bile Acid Sequestrant]
      J --> G
      G --> K{TG >= 200 & Non-HDL Chol. >= 160?}
      K -- No --> I
      K -- Yes --> L[TLC + Statin]
  
```

National Kidney Foundation Dialysis Outcomes Quality Initiative (K/DOQI) Clinical Practice Guidelines for Managing Dyslipidemias in Chronic Kidney Disease

## Vascular Disease in CKD

Classic Atherosclerosis – Intimal Calcification  
Uremic Arteriopathy - Medial Calcification



Vascular calcification in chronic kidney disease is caused by calcium-phosphate deposition.

Elevated serum Ca x P product seen in renal failure is major risk factor.

Treatment of renal osteodystrophy or 'rickets' (secondary hyperparathyroidism) also associated with high Ca x P.

"In Target"	K/DOQI
Calcium (mg/dL)	8.4 - 9.5
Phosphorus (mg/dL)	3.5 - 5.5
PTH (pg/mL)	150 - 300
Calcium x Phosphorus (mg <sup>2</sup> /dL <sup>2</sup> )	0 - <55

# PRIMARY CARE ISSUES IN CHILDREN WITH RENAL INSUFFICIENCY

SUDHA GARIMELLA

**Table 24. Normal GFR in Children and Young Adults**

Age (Sex)	Mean GFR ± SD (mL/min/1.73 m <sup>2</sup> )
1 week (males and females)	40.6 ±14.8
2–8 weeks (males and females)	65.8 ±24.8
>8 weeks (males and females)	95.7 ±21.7
2–12 years (males and females)	133.0 ±27.0
13–21 years (males)	140.0 ±30.0
13–21 years (females)	126.0 ±22.0

\*Data based on three studies.<sup>69-71</sup>  
Abbreviation: SD, standard deviation

**Table 10. Stages of Chronic Kidney Disease**

Stage	Description	GFR (mL/min/1.73 m <sup>2</sup> )
1	Kidney damage with normal or ↑ GFR	≥90
2	Kidney damage with mild ↓ GFR	60–89
3	Moderate ↓ GFR	30–59
4	Severe ↓ GFR	15–29
5	Kidney failure	<15 (or dialysis)

Chronic kidney disease is defined as either kidney damage or GFR <60 mL/min/1.73 m<sup>2</sup> for ≥3 months. Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

## SCHWARTZ FORMULA

- $K \times \text{Ht(cm)} / \text{Creat (mg/dl)}$ 
  - K=0.35 for premature infants
  - 0.45 for infants < 1 year
  - 0.55 for all girls > 1 year and boys < 12 years
  - 0.70 for boys > 12 years

## CARE ISSUES IN CHILDREN WITH RENAL INSUFFICIENCY

- IMMUNIZATIONS
- NUTRITION
- PSYCHOSOCIAL
- GROWTH
- TRANSITION TO ADULT CARE

## IMMUNIZATIONS

- CKD may result in abnormal response to routine immunization so that increased dose or monitoring of response may be necessary.
- Immunosuppressed patients should not receive live vaccines.
- Children needing a transplant may be immunized earlier than the norm.

## IMMUNIZATIONS

- Pediatric patients with CKD/Dialysis should receive all the vaccines currently recommended for healthy children according to the standard schedule.
- Children on immunosuppressive medications post renal transplant should also receive all standard vaccines except live vaccines [ VZV and MMR]

## IMMUNIZATIONS

- Every effort should be made to vaccinate children with CKD /Dialysis with MMR and VZV prior to transplant. Revaccinate patients without protective antibody titers.
- Children with Nephrotic Syndrome who receive steroids of more than 2mg/kg/day or 20 mg/day should not receive live vaccines.
- Delay live vaccination at least 1 month from stoppage of steroids.

## IMMUNIZATIONS

- HEPATITIS B
  - CKD -High Risk population
  - Augmented dose of 40 micrograms of either Recombivax HB or Engerix-B recommended for dialysis patients.
  - Post vaccination testing 1-2 months after series and then annually.
  - Up to 3 additional doses may be given.

## IMMUNIZATIONS

- MMR and VZV
  - CKD and Dialysis patients show good response to immunization.
  - Document antibody titers and revaccinate if needed prior to transplant.
  - Do not vaccinate transplant patients
  - Delay vaccination for nephrotics on steroids.

## IMMUNIZATIONS

- Pneumococcal vaccine
  - PCV-7 per standard recommendation at 2,4,6 and 12-15 months.
  - Children who have completed the PCV7 vaccination series before age 2 years should receive one dose of PPV23 at age 2 years (> 2 months after the last dose of PCV7).
  - Revaccinate every 3 yrs for child < 10 and every 5yrs for a child > 10 yr of age.
  - Nephrotic syndrome is also considered as high risk.

## IMMUNIZATIONS

- Others
  - Influenza- Standard
    - no dose adjustment for inhaled zanamivir
    - Oseltamivir- no data for dialysis patients- dose reduction for CKD needed.
  - Hepatitis A- No data
  - DTaP/Td- Standard
  - Hib, IPV-Standard
  - Rota- No data

## NUTRITION

- Increase in ESRD correlates to Obesity epidemic in adults.
- Protein energy malnutrition common in CKD and Dialysis patients.
- U shaped mortality curve in children with ESRD at either end of BMI.
- Peritoneal dialysis provides another way for nutrition.

## PSYCHOSOCIAL

- Pediatric Inventory of Quality of life- dialysis scores lower than transplant/healthy children.
- School- 79-94% dialysis kids attend fulltime, most miss 1/6 days.
- Children who start dialysis as infants- 25% have global developmental delay [mild-mod]
- I Q- low to low average, 15% receive special ed
- Help available for educational strategies

## GROWTH

- Careful nutritional evaluation and dietary support to children with CKD/dialysis.
- Consider Growth hormone use for improvement in final height.
- Vast improvements in PQOL and self esteem in children on dialysis with improvement in height.

## TRANSITION

- Gaps in health care can be critical
- As survival improves, more children will transition into adult programs
- ESRD teenagers lag the most among all chronic diseases in terms of achieving milestones critical to success in adult life
- Career counseling and vocational guidance very important.
- Insurance issues

## SUMMARY

- CHILDREN WITH RENAL PROBLEMS OFTEN HAVE SPECIFIC REQUIREMENTS THAT DIFFER FROM ROUTINE PRIMARY CARE PROTOCOLS.
- BETTER COMMUNICATION BETWEEN THE PMD AND THE NEPHROLOGIST HELPS MAINTAIN OPTIMAL HEALTH.