MAYO CLINIC

Renal disease and pregnancy

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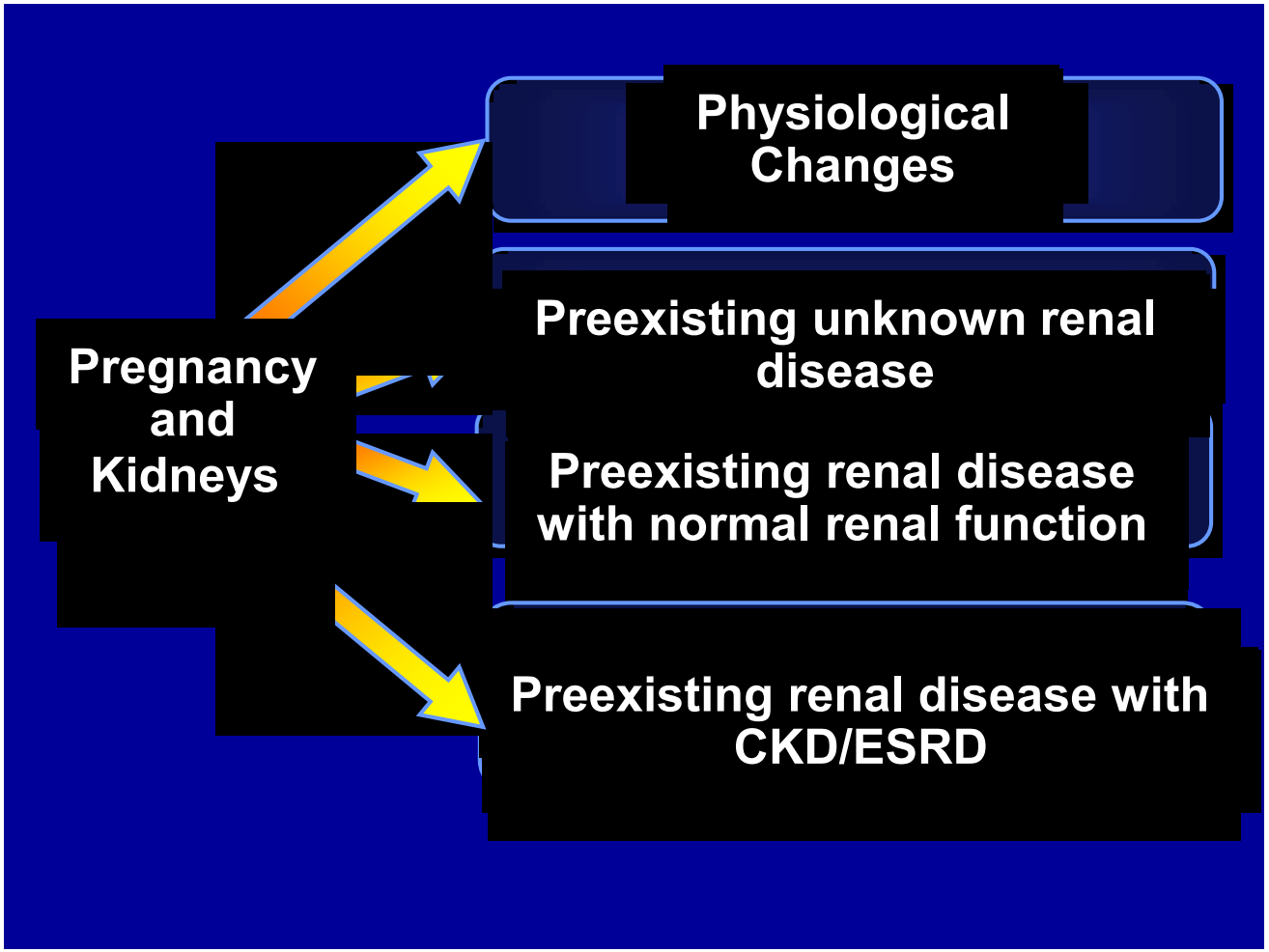
Physiological Changes of Pregnancy

- Physiological hydronephrosis, which is more prominent on the right side
  - Progesterone-induced ureteral smooth muscle relaxation
  - Ureteral compression 2nd to the enlarging uterus
- GFR increases by up to 50%
  - Elevations in cardiac output
  - ↑renal blood flow
  - Normal pregnancy: ↓Cr by an average of 0.4 mg/dL
  - Cr of 0.9 may indicate underlying renal disease

Pregnancy and Renal Disease



Pregnancy in Patients with Renal Disease

- Physiological increase in protein excretion
  - Increased GFR
  - ↑permeability of the glomerular basement membrane
  - Further exaggerated in patients with proteinuric renal disease, with worsening of proteinuria in 3rd trimester
- Pregnancy affects immune system
  - Altered Th1/Th2 balance, with Th2 polarization
    - ↓ Cell-mediated immunity, which could be detrimental to the allogeneic fetus
    - ↑ Production of antibodies
      - ? Auto-antibodies
      - SLE: disease of women of childbearing age

Pregnancy Effects on Preexisting Renal Disease

- Most important determinant of progression of renal insufficiency is renal function at the time of conception
- Possible contributing factors
  - Hypertension
  - ↑ Proteinuria during pregnancy
  - Urinary tract infections

Pregnancy in Patients with Chronic Renal Insufficiency

Risk factors for complications of pregnancy

- ↓ GFR
- Hypertension
- Nephrotic range proteinuria
- Advanced maternal age
- Underlying disease: poorly controlled DM, active SLE

Pregnancy in Patients with Preexisting Renal Disease

- Spontaneous abortions 8%
- Prematurity 19%
- Perinatal loss 13%

- Preeclampsia 30%
- IUGR 50%

Jungers, 1997

Pregnancy in Patients with Preexisting Renal Disease

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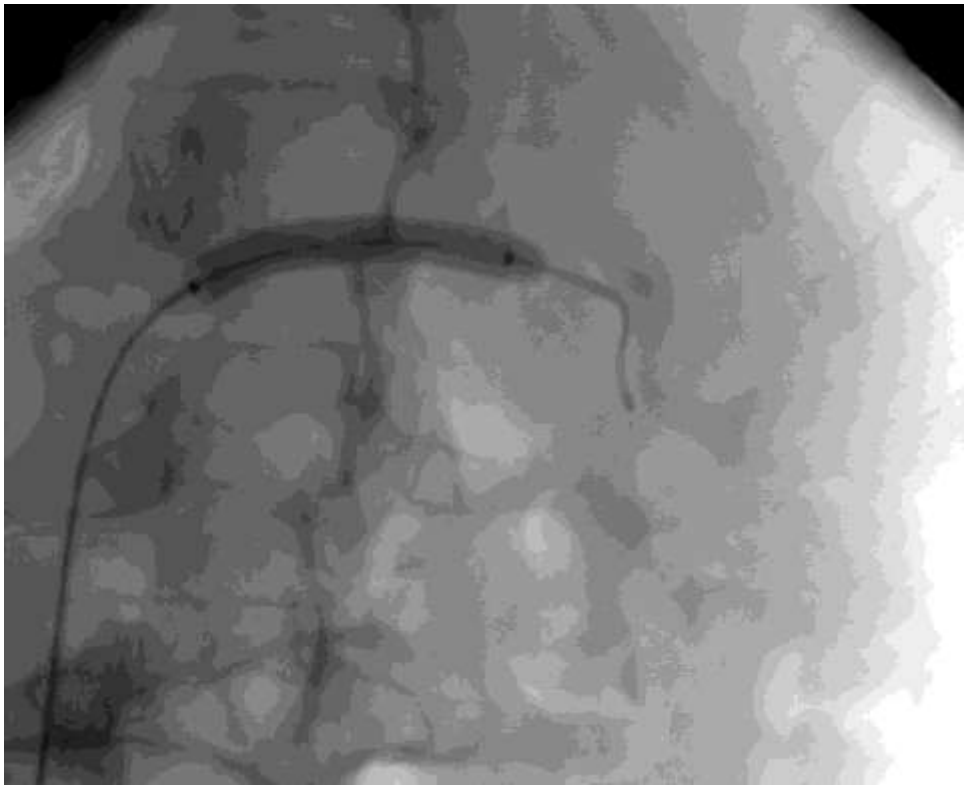
Renal Artery Stenosis in Pregnancy

- No prior history of hypertension
- Presented at 20 weeks gestation with
  - Preeclampsia
  - Placental abruption
  - Intrauterine fetal death
- At 6 weeks FU 160/90 on labetalol

Renal Artery Stenosis and Pregnancy

Renal Artery Stenosis and Pregnancy

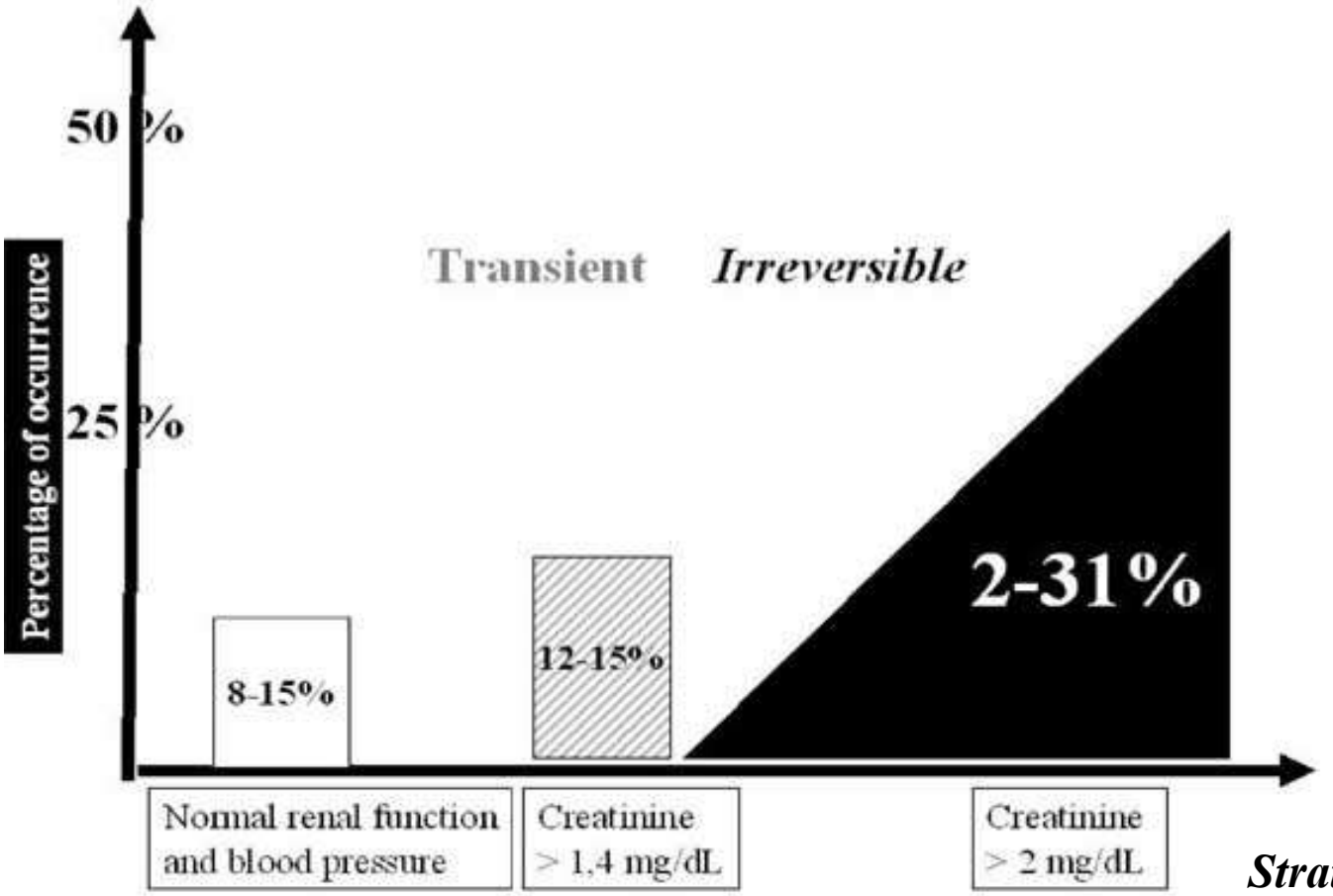
Renal Artery Stenosis and Pregnancy



Renal Artery Stenosis and Pregnancy

- Right atrophic kidney - nephrectomy
  - HTN resolved
- Uncomplicated pregnancy the following year

Risk of Worsening of Renal Function in Pregnancy by GFR



Stratta et al; 2006

Pregnancy Effects on Preexisting Renal Disease

Progression of Renal Insufficiency

- No adverse effect with Cr<1.4 mg/dL (124 µmol/L) and normal BP
- ↑progression if Cr ≥1.4 mg/dL (124 µmol/L)
- Cr ≥3.0 mg/dL (265 µmol/L); pregnancy losses and maternal morbidity
- Role of underlying disease
  - SLE/LN
    - In remission for 6 months

Pregnancy in Dialysis Patients

- Decreased fertility
- Menses: 10% early reports, 42% more recent
- Anovulatory cycles
- Normal estradiol levels
- ∅ LH OR FSH surges
- Low progesterone
- ↑Prolactin in 70-90%

Pregnancy in Dialysis Patients

Frequency of conception

- More frequent (2^{O} Erythropoietin)
- 1.4% per year Saudi Arabia
- 0.3% per year Belgium
- 0.5% per year USA

Pregnancy in Dialysis Patients

Frequency of conception in HD patients 2-3X >PD, due to

- Endocrine differences
- PD itself: tubal obstruction 2^{O} to peritonitis
- Ovum damage 2^{O} to hypertonic dextrose
- Impaired transport of ovum

Pregnancy in Dialysis Patients NPDR*

- Possible after 20 years of dialysis
- Conception rates as a function of time on dialysis
- Prematurity 85%
- IUGR 36%
- Congenital anomalies 10%
- Improved infant survival in women on dialysis<1 yr prior to conception

* The National Registry for Pregnancy in Dialysis Patients

Pregnancy in Dialysis Patients

- Conception rates as a function of time on dialysis

  Possible after 20 yrs of dialysis

- Repeated pregnancies, 318 NPDR*

  8 Women x2

  8 Women x3

  1 Woman x4

* The National Registry for Pregnancy in Dialysis Patients

Pregnancy in Dialysis Patients

Diagnosis of Pregnancy

- Urine test unreliable
- HCG levels borderline elevated in non-pregnant dialysis patients
- Ultrasound-for Dx and staging of pregnancy

Pregnancy in Dialysis Patients

- ↑ Incidence of hydramnios
- Fetus: Osmotic diuresis caused by ↑ BUN
- Intensive dialysis: Adjustments in Dialysate Composition
  ↑K^+ , ↓ Ca^{++}
- HCO_3 adjustment due to physiological respiratory alkalosis of pregnancy

Pregnancy in Dialysis Patients

Anticoagulation

- Pregnancy: ↑Coagulability
- Heparin-does not cross placenta
- Coumadin-does cross placenta, Teratogenic in the 1ST trimester, fetal bleeding in the 3RD trimester

Pregnancy in Dialysis Patients

- Pregnancy Outcomes NPDR

- Prematurity 85%
- IUGR 36%
- Congenital anomalies 10%
- Improved infant survival in women on dialysis<1 yr prior to conception

Pregnancy in Dialysis Patients

Infant Survival

- EDTA* 115 Pregnancies →23%
- Saudi Arabia 30%
- NPDR 222 Pregnancies, 141 reaching the second trimester→ 55%

* European Dialysis and Transplant Association

Pregnancy in Dialysis Patients

Daily HD treatments

- ↓ Fetal exposure to metabolic waste products
- ↓ Interdialytic weight gains
- ↓ Risk for hypotension with fluid removal
- Initial data from NPDR: improved outcome

ESRD and HD during Pregnancy

- Direct Comparison (excluding terminations)
  - *The Toronto Pregnancy and Kidney Disease (PreKid) Clinic and Registry*
    - *N=22*
    - *18 established ESRD patients*
    - *4 approaching ESRD*
  - *The American Registry for Pregnancy in Dialysis Patients*
    - *N= 70*
    - *57 established ESRD patients*
    - *13 approaching ESRD*

Hladunewich et al. JASN May 2014

Pregnancy in Dialysis Patients

- No reason to change either form of dialysis to another because of pregnancy
- PD: ↓ Volume and ↑ Frequency as pregnancy progresses or CAPD+ CCPD
- PD- Surgery should be performed extraperitoneally, can be resumed 24 hours post surgery

Intensified HD - Benefits

- Blood Pressure
- Left Ventricular Hypertrophy & Systolic Function
- Arterial Compliance
- Restores Endothelial Function
- Cardiac Autonomic Nervous System
- Phosphate
- Anemia
- Malnutrition
- Inflammation
- Cognition
- Fertility
- Quality of Life
- Quality of Sleep

Perl J and Chan C. AJKD. 2009; 54(6): 1171-1184.

Intensified HD during Pregnancy

Pregnancy Outcomes	Toronto	USA	P Value
Live Birth Rate (Entire Cohort)	19 (86%)	43 (62%)	0.030
1st Trimester Loss	1 (5%)	5 (7%)	
2nd Trimester Loss	0 (0%)	14 (20%)	
Neonatal Death	1 (5%)	5 (7%)	
Still Birth	1 (5%)	3 (4%)	
Live Birth Rate (ESRD only)	15 (83%)	30 (53%)	0.020
Among Patients with Established ESRD			
Dialysis Time (Hours/Week)	43±6	17±5	<0.001
Gestational Age (Weeks)	36 (32-37)	27 (21-35)	0.002
Among Patients with Renal Failure During Pregnancy			
Dialysis Time (Hours/Week)	33±6	15±4	<0.001
Gestational Age (Weeks)	35 (29-37)	33 (31-37)	NS
All Pregnancies (Except 1st and 2nd Trimester Losses)			
Dialysis Time (Hours/Week)	42±7	17±5	<0.001
Birth Weight (grams)	2118±857	1748±949	NS
Among Surviving Infants in Established ESRD Patients			
Normal Birth Weight	8 (50%)	10 (32%)	NS
Low Birth Weight (<2500g)	7 (44%)	12 (39%)	
Very Low Birth Weight (<1500g)	1 (6%)	9 (29%)	

Hladunewich et al.
JASN May 2014

Management Strategy

- Dialysis Prescription
  - 6-8 hours/day, 6-7 days per week
  - Minimum 36 hours
- Avoid Intra Dialytic Hypotension
  - Low blood flow rates
- Polyhydramnios
  - Fetal solute diuresis secondary to increased placental BUN
  - Adjust HD prescription
- Postpartum
  - Go back to conventional temporarily
  - Transplant

Management Strategy

Vitamins, Minerals and Diet	• Double dose of MVI • Folic acid 5 mg daily • Unrestricted Diet • Daily protein intake 1.5-1.8 g/kg/day
Electrolytes	• 3 mEQ/L K bath
Bone Health	• Dialysate Calcium at least 1.75 mmol/L • Close f/u PO4 • Follow PTH
Anemia	• IV and oral iron to maintain normal stores • ESA to target a hemoglobin of 110 g/L
Volume Status	• Monthly then weekly volume assessments
Hypertension	• Target post-dialysis BP < 140/90 mmHg

Hladunewich et al.Seminars in Dialysis 2011

Questions?