

# Pregnancy & the Kidney

---

- Amy K Mosman, MMS, PA-C
- SSM SLUCare Division of Nephrology
- American Academy of Nephrology PAs
- No disclosures



# Objectives

1

Review physiological changes during pregnancy as they affect the kidney

2

Highlight the warning signs and conditions relating to the kidney during pregnancy and the postpartum period

3

Discuss fertility and pregnancy management in late-stage kidney disease

# As a PA in Nephrology...

- Lots in Common with PAs in OB/GYN
  - Small group, big potential
  - Strong patient relationship over time
  - Frustratingly low level of research, evidence based lit available (albeit changing)
  - Gotta go with your gut

# Physiologic Changes in Pregnancy

- Enlargement: 30% increase in renal volume, 50-80% increased renal blood flow, 50% increase in GFR
  - BUN <13, S Cr to 0.4 - 0.5 mg/dL common; S Cr 0.7 - 0.8 mg/dL or higher by midway point concerning
- Proteinuria due to increased permeability of glomerular basement membrane (up to 300 mg/24 hrs)
- Average weight increase includes ~9L water
  - increase via increased RAAS activity for sodium and water retention in setting of systemic vasodilation
  - leads to hemodilution (RBC increase < fluid increase) and increased cardiac output
  - Reset osmostat also seen

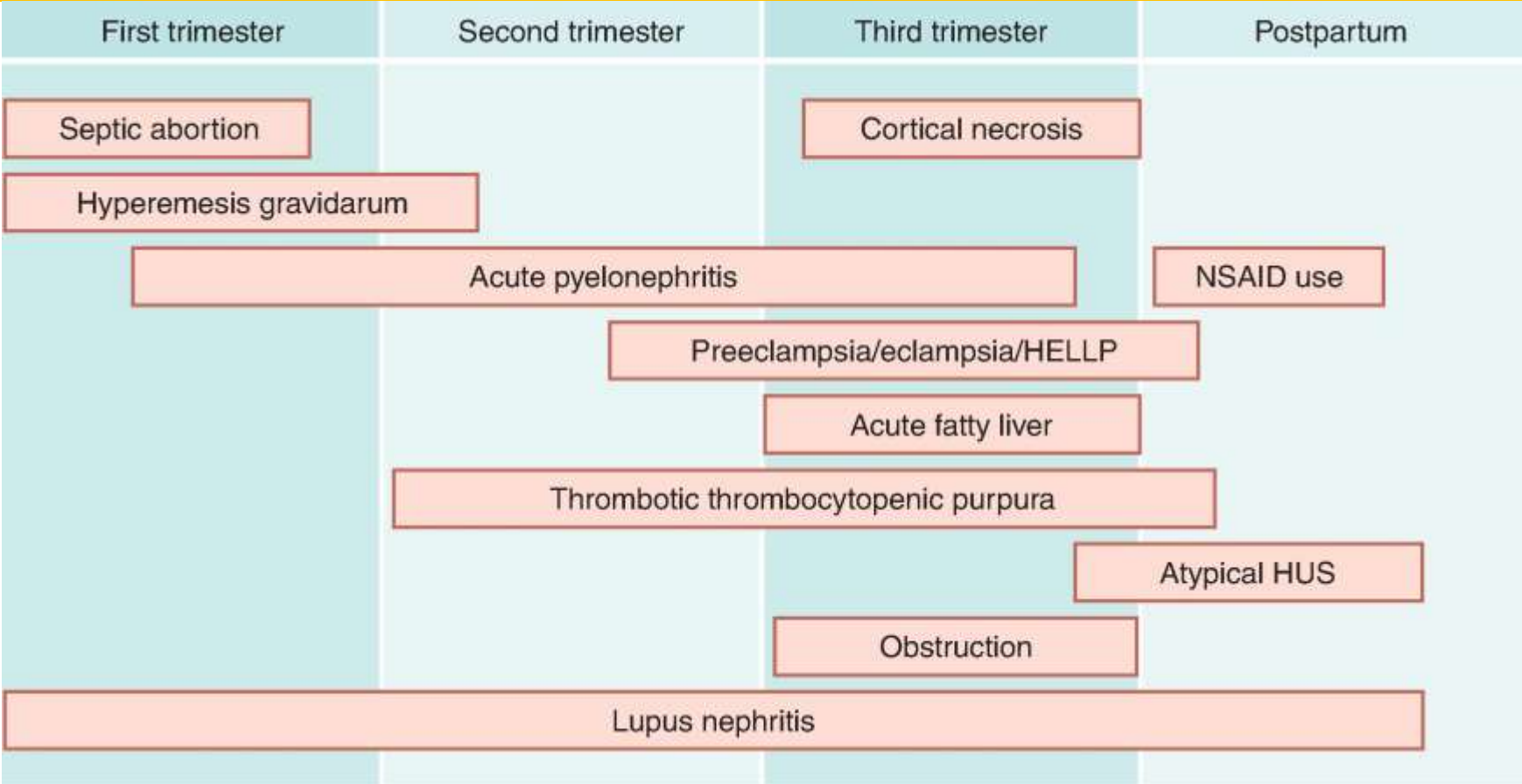


Ribeiro CI, Silva N. Pregnancy and dialysis. *J Bras Nefrol.* 2020;42(3):349-356. doi:10.1590/2175-8239-JBN-2020-0028

Forestiero V, Sconfienza E, Mulatero P, Monticone S. Primary aldosteronism in pregnancy. *Rev Endocr Metab Disord.* 2023;24(1):39-48. doi:10.1007/s11154-022-09729-6.

Vellanki K, Hou S. The kidney in pregnancy. In: Gilbert SJ, Weiner DE, Gipson DS, Perazella MA, Tonelli M, eds. *National Kidney Foundation's Primer on Kidney Diseases.* 6th ed. Elsevier; 2014: 427-436.

# Renal Pregnancy Risks



Tangren J, Hladunewich MA. The kidney in pregnancy. In: Gilbert SJ, Weiner DE, Gipson DS, Perazella MA, Tonelli M, eds. *National Kidney Foundation's Primer on Kidney Diseases*. 8th ed. Elsevier; 2023: 440-450.

# Risks to the kidney patient in pregnancy

- Progression to ESRD
- PKD patients – increased liver cysts, brain aneurysm rupture, increased risk of bacteruria, severe UTIs
- Lupus flare
- Transplant rejection
- ESRD
- Fetal demise



# Case of the Hypertensive Patient

- 39 yo African American female, G2P0110, history of pregnancy w/ intrauterine fetal demise, chronic hypertension with superimposed PEC w/ severe features
- Referred to nephrology due to difficulty controlling BP and replacing potassium in setting of current ART (letrozole IUI) pregnancy at 32 weeks gestation
- On chart review, found that during last SAB, seen by nephrology and evaluated for secondary HTN but did not realize additional follow up was necessary on discharge



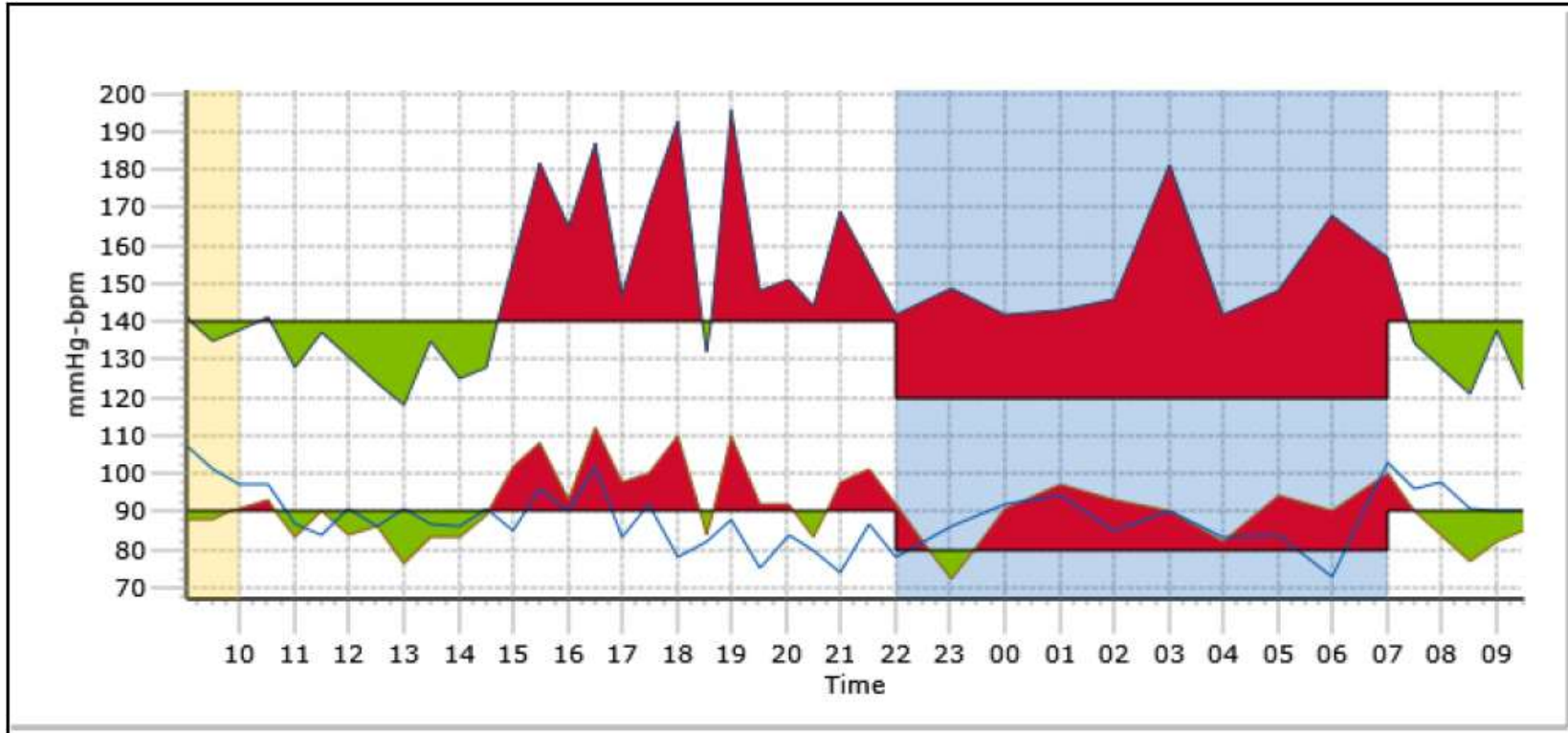
# Case of the Hypertensive Patient

- Meds: labetalol 400 mg BID, nifedipine 30 mg daily, potassium 20 mEq BID
- No LEE, foamy urine, HA, CP, SOB, + myalgias
- BP 124/88, HR 96, RR 18, 218 # (BMI 35 at start of pregnancy)
- Potassium 3.4, (up from 3.1 - 3.2), S Cr 0.7 (baseline 0.8-0.9)
- A1c 5.3%, normal GTT, normal UA
- At time of last pregnancy, aldosterone 55, ARR 20
- No changes at first meeting except doubling of K supplementation, 24 hr ambulatory BP monitor





# Case of the Hypertensive Patient



**Brachial BP Results**

Period	Time	Samples	Mean SYS mmHg (+/- Std.Dev)	Mean DIA mmHg (+/- Std.Dev)	Mean HR BPM (+/- Std.Dev)	BP Load Sys (%)	BP Load Dia (%)
Overall	09:01-09:30 (24:29)	41	147 (+/-20.1)	91 (+/-9.3)	89 (+/-7.9)	61	56



# Primary Hyperaldosteronism

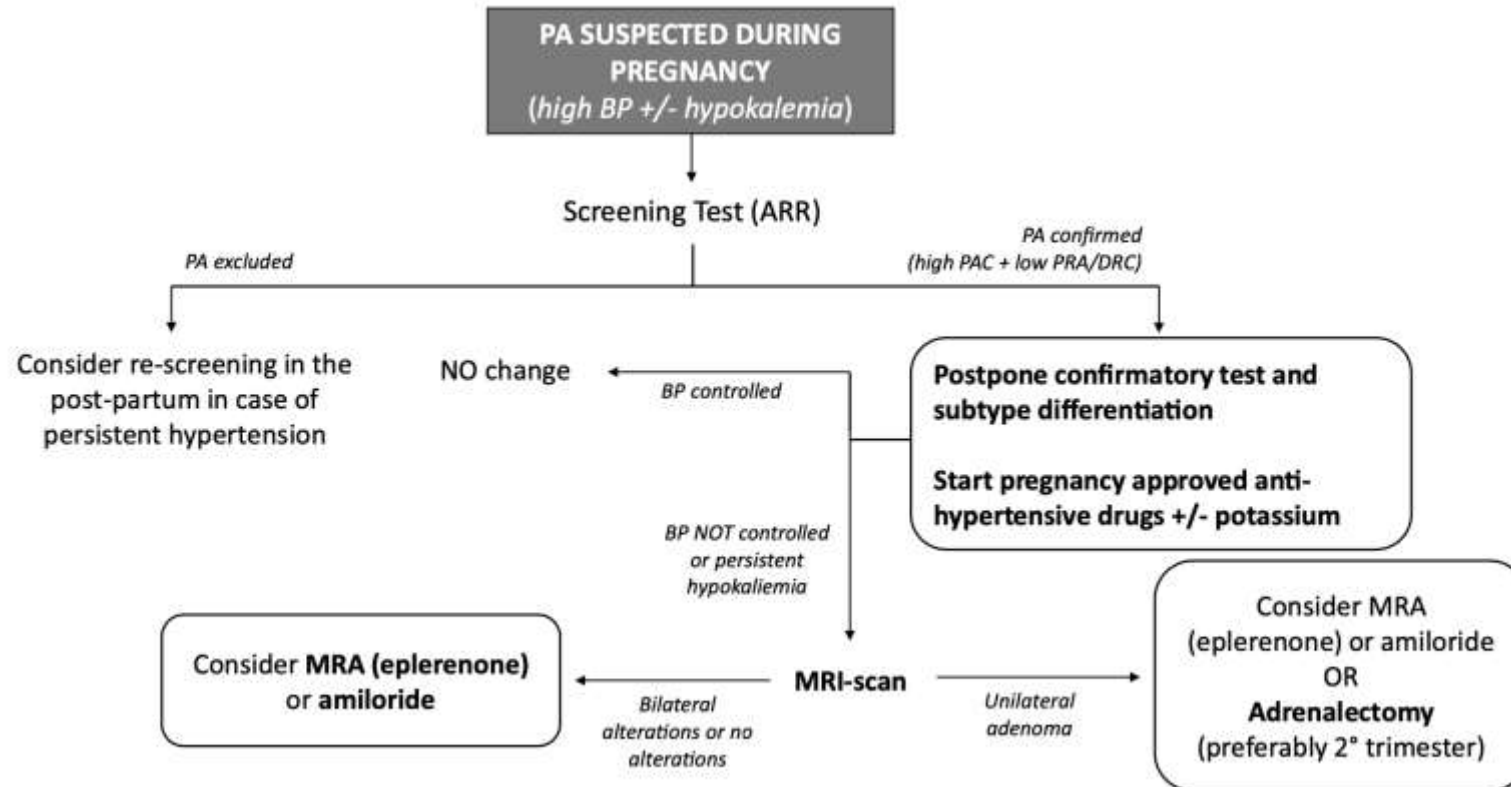
- Hypertension complicates up to 10% of pregnancies
- Hyperaldosteronism: most common cause of secondary HTN, 1 in 6 resistant HTN cases in the general population
  - Up to 25% of patients with unresolved HTN 6 months post partum may have a secondary cause of HTN
- Difficult to diagnose fully in pregnancy as can have 10-20x higher aldosterone levels in pregnancy, 8x higher renin, 4x higher angiotensin
- Hypokalemia significant and replacement crucial for maternal and fetal outcomes

Forestiero V, Sconfienza E, Mulatero P, Monticone S. Primary aldosteronism in pregnancy. *Rev Endocr Metab Disord*. 2023;24(1):39-48.  
doi:10.1007/s11154-022-09729-6.

Vellanki K, Hou S. The kidney in pregnancy. In: Gilbert SJ, Weiner DE, Gipson DS, Perazella MA, Tonelli M, eds. *National Kidney Foundation's Primer on Kidney Diseases*. 6th ed. Elsevier; 2014: 427-436.



# Primary Hyperaldosteronism



# Case of the Pregnancy with Advanced CKD

- 23 yo African American female, G2P0100 referred for severe renal failure at 28 weeks gestation
- Previous pregnancy c/b AKI requiring hemodialysis 5x/week, delivery at 35 weeks due to PEC SF/FGR/anhydramnios/fetal hypoplastic Rt heart disease and ultimate loss of infant at 3 months
- Was lost to follow up
- Presented to MFM @ 20 weeks gestation this pregnancy
- Had kidney biopsy in past with acute tubular injury, suspected AIN/CIN from NSAID use



# Case of the Pregnancy with Advanced CKD

- Last known S Cr pre-pregnancy (1 year prior) 4.2
- BP 115/65, HR 75, 110# (BMI ~18 pre-pregnancy), no edema
- BUN 80, S Cr 5.5, K 4, bicarbonate 16, Hgb 6.3



# Pregnancy with ESRD

- Low rates, but increasing:
  - Decreased libido, polypharmacy, depression
  - Amenorrhea and anovulatory cycles norm at eGFR <5 mL/min
  - Residual renal function increases likelihood and success rates
- Serum HCG may be falsely elevated in ESRD with low clearance – US confirmation needed
- Successful outcomes: ~80% pre-dialysis pregnancy, 50% prevalent dialysis pregnancy
- Risks to mom: Hypertension, PE, anemia, infections
- Risks to fetus: infections, fetal growth restriction, prematurity



**TABLE 1** HEMODIALYSIS AND PERITONEAL DIALYSIS PROS AND CONS DURING PREGNANCY

Hemodialysis	
Pros	Cons
Less dietary restrictions	Worse metabolic control (intermittent dialysis)
Less water restriction	Higher risk of hemodynamic instability
Less overload using the technique	Need for hypocoagulation
	Lower autonomy

Peritoneal dialysis	
Pros	Cons
Better metabolic control (continuous dialysis)	Higher risk of infectious complications †
Lower risk of hemodynamic instability	Higher risk of non-infectious complications □
Higher degree of autonomy	More difficulty managing volume
No need for anticoagulation	Higher % of intrauterine growth restriction
Preserving residual kidney function	Increase in the frequency of exchanges ‡

† Peritonitis/peritoneal dialysis catheter tunnel infection/outlet orifice infection

□ Peritoneal dialysis catheter dysfunction caused by obstruction/shifting or associated pain

‡ Volume increase is not tolerated, especially in the last trimester

# Pregnancy with ESRD

- Recommendations for RRT initiation
  - Goal BUN <50, minimum of 36 hrs per week HD
  - Higher MVI use, protein intake
  - Target BP 140/90 post-dialysis
  - Avoid hypocalcemia, hypotension
  - Watch for metabolic alkalosis and acidosis especially with frequent HD
  - If on PD, eventual switch to HD usually necessary

Tangren J, Hladunewich MA. The kidney in pregnancy. In: Gilbert SJ, Weiner DE, Gipson DS, Perazella MA, Tonelli M, eds. *National Kidney Foundation's Primer on Kidney Diseases*. 8th ed. Elsevier; 2023: 440-450.

Ribeiro CI, Silva N. Pregnancy in dialysis. *Braz. J. Nephrol. (J. Bras. Nefrol.)* 2020;42(3):349-356.





# Pregnancy and Kidney Transplant

- Fertility, libido returns with transplant
- Remain at risk for PE, prematurity, low birth weight + risk of graft loss
- Ideally wait until at least 1 year out of transplant without signs of infection, rejection
- Immunosuppressants must be revised for teratogenicity
  - No MMF/Cellcept
  - OK: CNI (cyclosporine, tacrolimus), steroids, azathioprine

Tangren J, Hladunewich MA. The kidney in pregnancy. In: Gilbert SJ, Weiner DE, Gipson DS, Perazella MA, Tonelli M, eds. *National Kidney Foundation's Primer on Kidney Diseases*. 8th ed. Elsevier; 2023: 440-450.





Thank you!