Kidney in Pregnancy

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Which of the following is NOT a normal finding in pregnancy?

1. Bilateral hydronephrosis
2. Hypernatremia
3. Respiratory alkalosis
4. Anemia
Which of the following is not commonly associated with pregnancy?

1. Bilateral hydronephrosis
2. **Hypernatremia**
3. Respiratory alkalosis
4. Anemia
Urinary tract physiology in pregnancy

- Progesterone dilates collecting system
- Prostaglandins causes ureteral hypomotility
- Uterus compresses ureters at pelvic brim
  - Physiologic hydronephrosis of pregnancy
  - Vesicoureteral reflux
  - Increased susceptibility to UTIs and pyelonephritis
Successive urograms in normal pregnancy

Hundley at al, 1935
Cardiovascular physiology in pregnancy

- Drop in peripheral vascular resistance due to progesterone and vasodilating prostaglandins
- Drop in BP
- Rise in cardiac output
- Rise in blood volume by 50% with “physiologic anemia of pregnancy”
Renal physiology in pregnancy

- Renal Na retention with edema/volume expansion
- GFR increases by 50%
- Preserved tubulo-glomerular feedback
- Preserved concentrating and diluting ability
Renal physiology in pregnancy

- Increased activity of RAAS system
- Hyponatremia (due to reset osmostat)
- Respiratory alkalosis
- Glucosuria
A 27-year-old woman who is 30 weeks pregnant presents to her OB with BP 150/105. She was previously normotensive. Urinalysis reveals a SG of 1.020 with 1+ proteinuria and no cells. Serum uric acid is 5.0 mg/dL. Platelet count and LFTs are normal. 24-hour urine collection shows 1.1 g of protein.

Which of the following does this patient most likely have?

(A) Chronic hypertension
(B) Gestational hypertension
(C) Normal blood pressure for pregnancy
(D) Preeclampsia
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Hypertension in Pregnancy

- Chronic hypertension
- Gestational hypertension
- Preeclampsia-eclampsia ("pregnancy-induced hypertension")
- Preeclampsia superimposed upon chronic hypertension
Hypertension in Pregnancy

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Chronic hypertension

Present antepartum, present before 20 wks, and persists >12 wks postpartum

Systolic BP ≥ 140 mm Hg
or
Diastolic BP ≥ 90 mm Hg

American Congress of Obstetrics, 2000
Hypertension in Pregnancy

- Chronic hypertension
- **Gestational hypertension**
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Definition of gestational hypertension

Developing after 20 wks in a previously normotensive woman, or significant worsening of BP after 20 wks

Systolic BP $\geq 140$ mm Hg

or

Diastolic BP $\geq 90$ mm Hg

and

No proteinuria

American Congress of Obstetrics, 2000
Hypertension in Pregnancy

- Chronic hypertension
- Gestational hypertension
- **Preeclampsia**-eclampsia ("pregnancy-induced hypertension")
- Preeclampsia superimposed upon chronic hypertension
Definition of preeclampsia

Developing after 20 wks in a previously normotensive woman, or significant worsening of BP after 20 wks

Systolic BP $\geq 140$ mm Hg

or

Diastolic BP $\geq 90$ mm Hg

and

Proteinuria $\geq 300$ mg/24 hrs

American Congress of Obstetrics, 2000
Hypertension in Pregnancy

- Chronic hypertension
- Gestational hypertension
- Preeclampsia-eclampsia ("pregnancy-induced hypertension")
- Preeclampsia superimposed upon chronic hypertension
A 41 yo nulliparous woman who underwent IVF is now pregnant with twins. She is in good health, but is obese and has a 20-year smoking history. At 32 weeks she is hypertensive (145/98) and has proteinuria (urine prot/cr ratio 1.7). Five days later she c/o persistent severe headache and RUQ abdominal pain. The BP is 165/108. Plt ct is 70, cr 1.3, AST 94, ALT 92.

Which statement is true?

(A) Risk factors for preeclampsia include primigravida status, advanced maternal age, multiple gestation pregnancy, cigarette smoking, and obesity

(B) Definitive treatment is delivery

(C) Preeclampsia could have been averted with low dose aspirin and calcium supplementation during pregnancy

(D) A and B
Development of preeclampsia

Karumanchi et al, KI, 2005
Abnormal placentation

Normal pregnancy

Preeclampsia

Karumanchi et al, KI, 2005
Systemic endothelial dysfunction

Maynard, 2003
Systemic endothelial dysfunction

- Placental ischemia
- Imbalance between placental production of angiogenic and anti-endothelial factors
  - \textit{sFlt} – soluble antagonist of VEGF
  - \textit{sEng} – soluble co-receptor for TGF-\(\beta\)
- Anti-angiogenic state resulting in systemic endothelial dysfunction
Systemic endothelial dysfunction

- Disturbed endothelial control of vascular tone (HTN)
- Increased vascular permeability (edema, proteinuria)
- Abnormal endothelial expression of procoagulants (thrombotic complications)
Development of preeclampsia v2011

Immunologic factors
Hypoperfusion
Abnormal placentation

sFLT
sEng

Eclampsia = PRES
Hypertension

- Increased peripheral vascular resistance
- Exaggerated response to vasoconstrictors
- Increased serum markers for endothelial activation and dysfunction
- Imbalance between PGI$_2$ and TXA$_2$
Edema

- “Overfill” edema
- GFR is reduced out of proportion to RBF, impaired tubulo-glomerular feedback, salt retention
Edema

- Renin/aldo suppressed
- Increased capillary permeability
Renal injury in preeclampsia, LM

2005 UpToDate
Renal injury in preeclampsia, EM

2005 UpToDate
Proteinuria

- Due to reduced size and charge selectivity (Moran et al, JASN, 2003; Naicker et al, Nephron, 1997)
- Subnephrotic to nephrotic
- Urine dipsticks are unreliable
- Correlates with severity of preeclampsia
- Resolves within 2 mo postpartum
Microangiopathy

- Usually indolent, but can progress to HELLP
- Abnormal endothelial factors (PGI$_2$, vWF, thrombomodulin, fibronectin) cause platelet activation and consumption coagulopathy
Our patient with preeclampsia is placed on bed rest, and you want to start antihypertensive medications.

Which of the following medications would be used as a first-line agent for treatment of hypertension?

(A) Captopril
(B) Lasix
(C) Intravenous (IV) magnesium sulfate
(D) Methyldopa
(E) Norvasc
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Antihypertensive meds in pregnancy

- In **preeclampsia and gestational HTN**, tx is recommended for severe HTN (>160/105) to reduce maternal complications
- PO: methyldopa, labetalol, nifedipine, hydralazine
- IV: labetalol, hydralazine, nicardipine
- Goals of tx: BP 140-155/90-105
Antihypertensive meds in pregnancy

- In **chronic HTN**, some of the pre-pregnancy regimen can be continued
- Preferred meds: methyldopa, hydralazine, labetalol, Ca-channel blockers
- Can be continued: thiazide diuretics, clonidine
- Stop: ACEI and ARB, DRI, MRAs
- Goals of tx: BP 140-150/90-100, hold meds if BP <120/80
Acute renal failure in pregnancy

- Prerenal/ATN in first trimester
- TMA
  - TTP
  - Preeclampsia
- Renal Cortical Necrosis
- Acute pyelonephritis
- Nephrolithiasis/obstruction
Pregnancy in CKD

- Good maternal and fetal outcomes with cr <1.4

- Diabetic nephropathy
  - Strict BP and BG control improves outcomes
  - Treat retinopathy before pregnancy

- SLE:
  - Remission >6-12 mo
  - Judicious use of immunosuppressives, no MMF
  - Pregnancy is contraindicated in APS
Pregnancy in ESRD

- Fertility markedly reduced – most ESRD pregnancies happen before dialysis initiation
- Pregnancy can be carried to term with HD or PD
- Aggressive dialysis dosing, aggressive BP control, aggressive anemia control
Pregnancy in renal transplantation

- Fertility is restored
- Maternal and fetal outcomes are good
- Requirement for stable renal fxn x 1-2 yrs post transplant
- MMF and Rapamycin are contraindicated
- Cyclosporine, azathioprine, prednisone are allowed