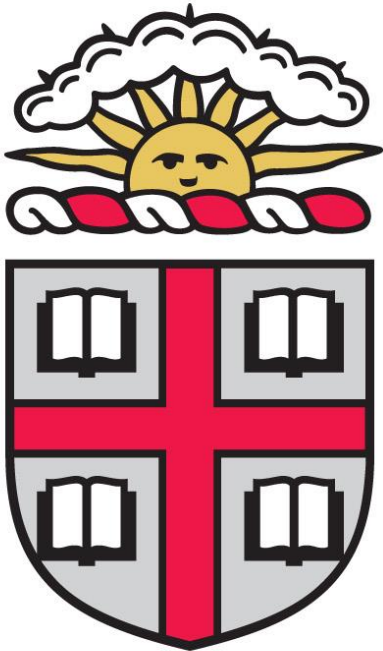


Five Things I Learned about Nephrolithiasis in Pregnancy

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Women & Infants

New England's premier hospital for women and newborns



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1.

Nephrolithiasis in pregnancy is commonly encountered



Background:

- Renal colic is the most common cause of non-obstetric abdominal pain necessitating hospitalization.
- Incidence 1/200 to 1/1500 pregnancies, same as the general population.
- Majority occur in second or third trimester.
- Multiparous greater than primiparous 3:1.



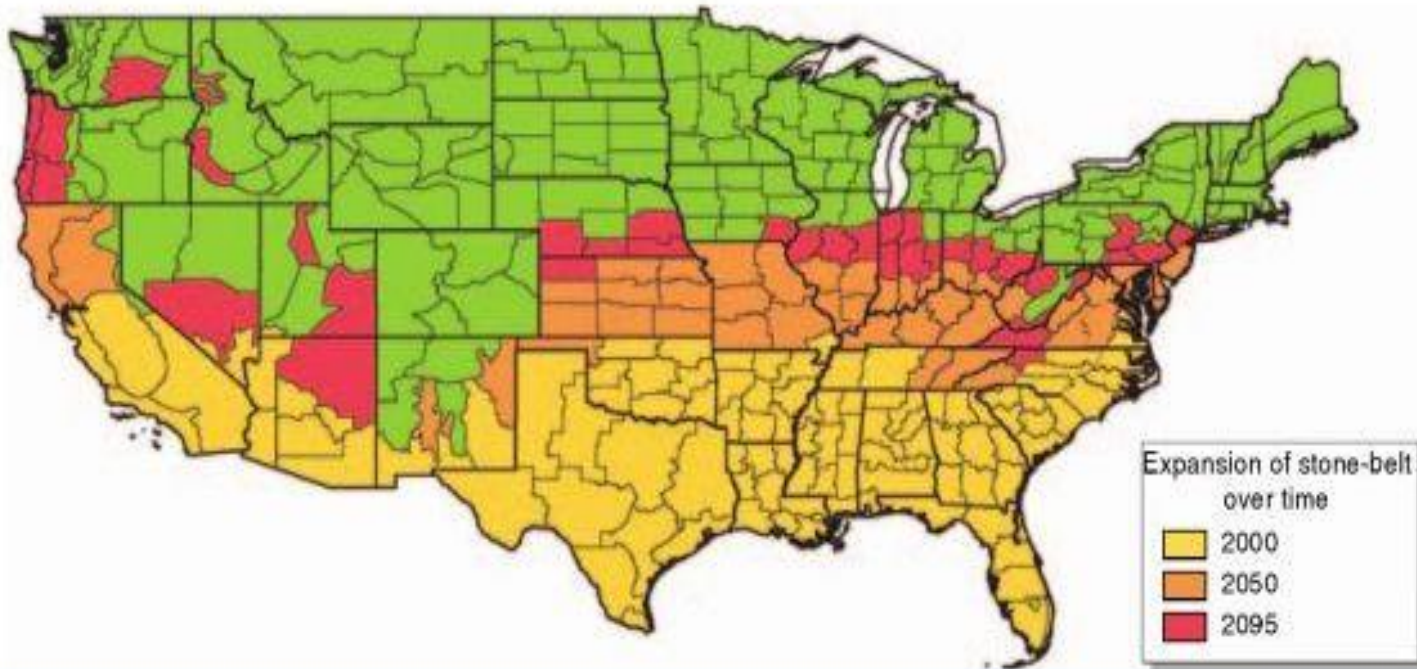
Incidence in General Population

- Stones affect 10% of general population.
- Incidence increasing steadily over the last decade.
- 40% increase in hospital visits.
- 50% increase in annual expenditure from 1992-2000.

Urologic Diseases of America Project: urolithiasis. *J. Urol.* 173, 848–857 (2005).
Time trends in reported prevalence of kidney stones in the United States: 1976–1994.
Kidney Int. 63, 1817–1823 (2003).

Stone Belt of America

Medscape



Source: Kidney Int © 2011 International Society of Nephrology



Incidence:

- In general population, incidence increasing presumably from:
 - Obesity
 - Environmental changes
 - Increased incidence of comorbidities like Diabetes Mellitus and Metabolic Syndrome



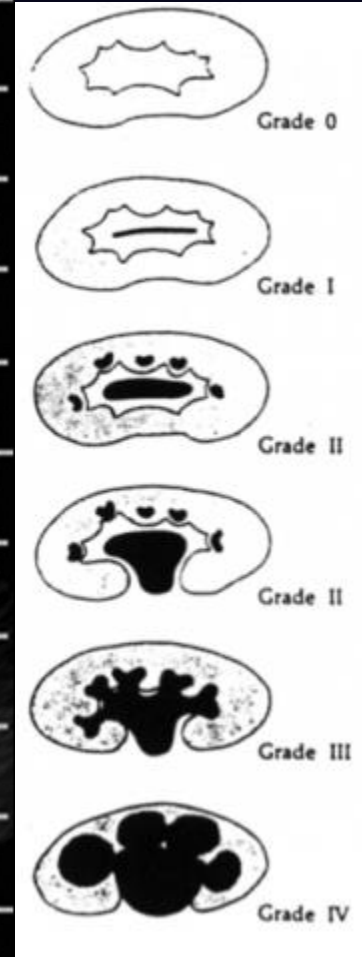
2.

Several Anatomic and
Physiologic Changes of
Pregnancy Affect Stone
Formation



Anatomical Alterations in the Urinary Tract in Pregnancy

Pregnancy Hydronephrosis



Hydronephrosis

- 90% of the right kidneys and 67% of the left kidneys.
- Mechanical Effect:
 - Preferential compression of the right ureter due to dextrorotation of the uterus and compression by ovarian vein plexus.
 - Protection of the left ureter by the gas filled sigmoid colon.



Physiologic Hydronephrosis

- Hormonal Effect:
 - Progesterone induced smooth muscle dilatation, resulting in reduced ureteral peristalsis and further dilatation.
 - Responsible for the hydronephrosis seen early in pregnancy, 6-10 weeks.



Physiologic Alterations in the Urinary Tract in Pregnancy



Renal Physiology in Pregnancy

- Increased GFR and renal plasma flow due to:
 - Increased cardiac output.
 - Decreased renal vascular resistance.
- Cr clearance increases by 50%.



Excretion of Stone Related Substances in Pregnancy



Sodium

- Increased circulating levels of natriuretic hormones: progesterone, HCG, aldosterone



Gestational Hypercalciuria

- Increased GFR → increased filtered load of Calcium.

Gestational Hypercalciuria

Placental hydroxylase enzyme

Increased 1-25 dihydroxy Vit D3 production

Increased intestinal absorption of Calcium

Negative feedback suppression of PTH

Decreased tubular resorption of calcium






Gestational Glycosuria

- Pregnancy is associated with a lowering of the renal threshold for glucose excretion.
- Increased GFR leads to increased glucose load in the urine.
- Reabsorption is compromised due to overwhelming load.



Renal Physiology in Pregnancy

- Increased renal filtration of potential stone promoters
 - Glucose, Na, Ca and uric acid



Ureteral obstruction+ dilatation →
Urinary stasis → Longer contact
time between lithogenic factors →
enhanced crystallization.



Stone Incidence in Pregnancy

- Despite this, pregnancy is not associated with an increased incidence of stone formation
- limited duration
- Increased filtration of stone inhibitors:
 - Citrate, magnesium, glycosaminoglycans
 - Nephrocalcin, uromodulin, thiosulfate



Stone Composition in Pregnancy

- Calcium phosphate stones predominant stone type in pregnancy whereas oxalate more common in general population.



3.

USG is the Imaging Modality
of Choice



X-ray Procedures during Pregnancy: Key Points to Review

- No teratogenic effect of radiation if total radiation exposure is kept below 5 rads throughout gestation.
- Almost all radiologic procedures involve far less than 5 rads of radiation.

Radiation Exposure Associated With Some Common Diagnostic Imaging



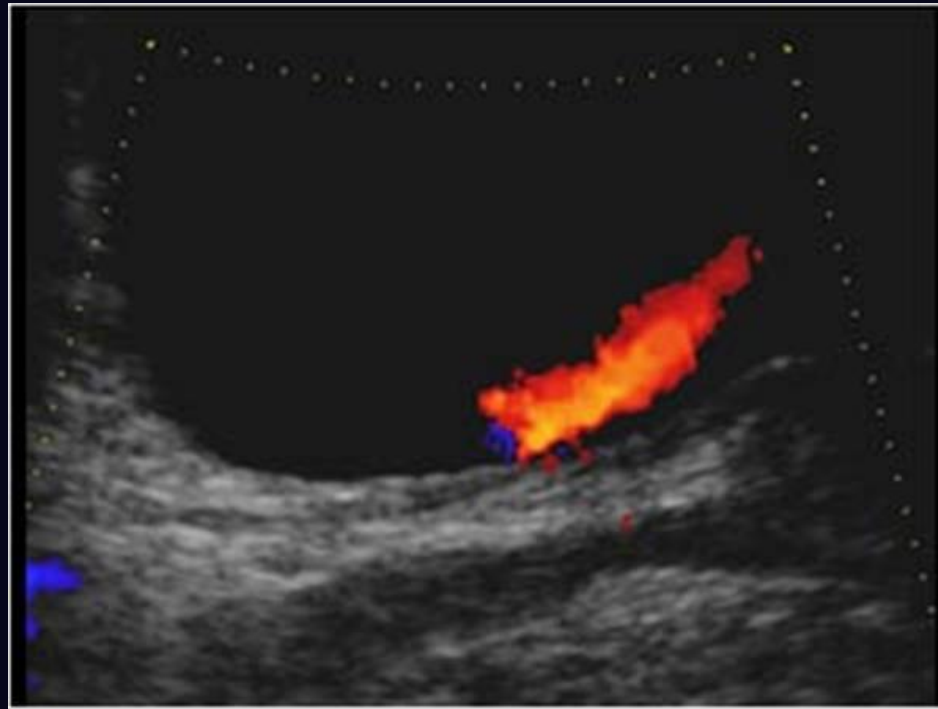
Type of Imaging	Radiation Exposure (RADS)
Head CT	<.001
Chest Xray	<.001
Abdominal film (single view)	.01
Intravenous pyelogram	>1.0 rad
Abdominal CT	>3.0 rad



Role of US in Diagnosis of Urolithiasis

- Reported sensitivities for detection of renal or ureteral calculi.
 - 34-95% (likely lower end).

Differentiating Physiologic Hydronephrosis from Obstructive



Ureteral Jets: Absence on affected side suggests obstruction.
Reported sensitivity 100%, specificity 91%.



Renal USG and Stones in Pregnancy

- Ureteral Jets: 15% of asymptomatic pregnant women will have absent unilateral jets.
- Imaging in the contralateral decubitus position is recommended.



Transvaginal US

- For detection of distal ureteral calculi, particularly if transabdominal US is inconclusive



Other Imaging Modalities

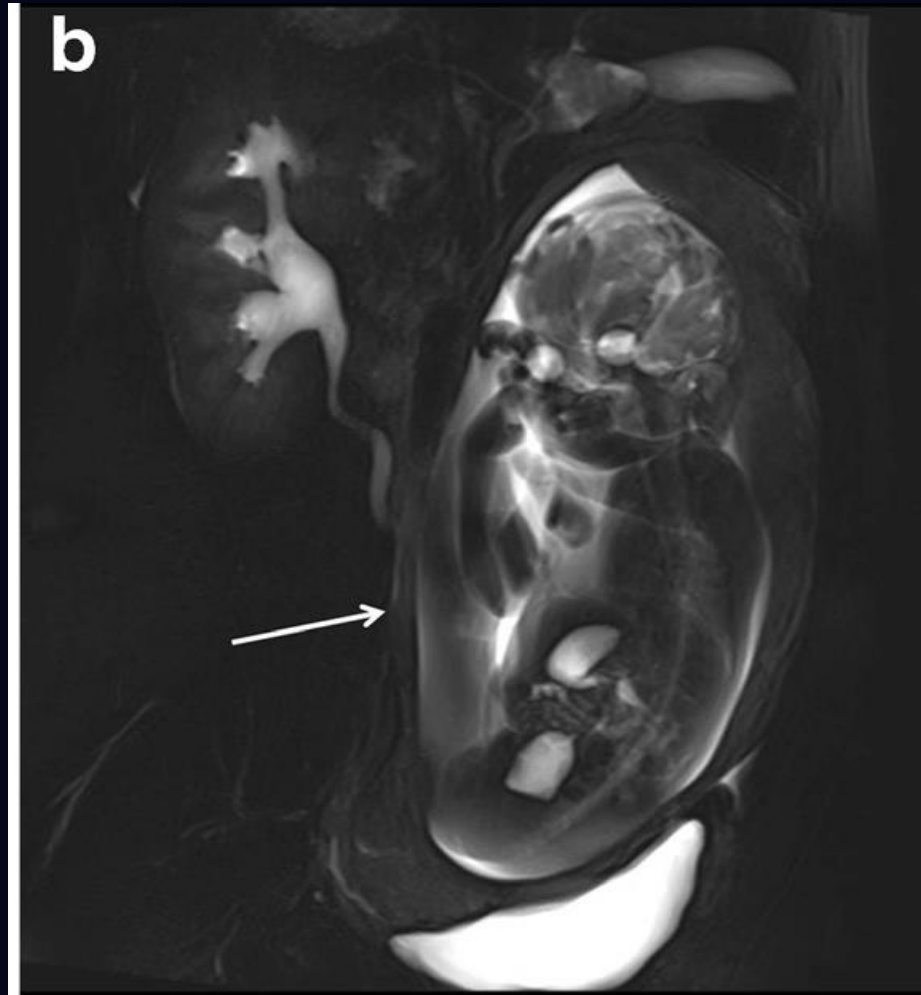
- If diagnosis unclear from USG
 - T2-weighted half-fourier single-shot turbo-spin echo (HASTE) MRU (Magnetic Resonance Urography)



MR Urography

- Second line test after US in pregnant pts
 - Relatively insensitive for direct detection of small renal stones.
 - But can show secondary changes of obstruction (Renal enlargement and perirenal fluid).

MRU





Intravenous Pyelogram

- Superior visualization of ureters compared with US.
- Less radiation than CT.
- Limited 3 shot IVP: scout film, 30 second and 20 minute films.
- Single shot IVP: single film 5 minutes after IV contrast injection.



IVP





IVP

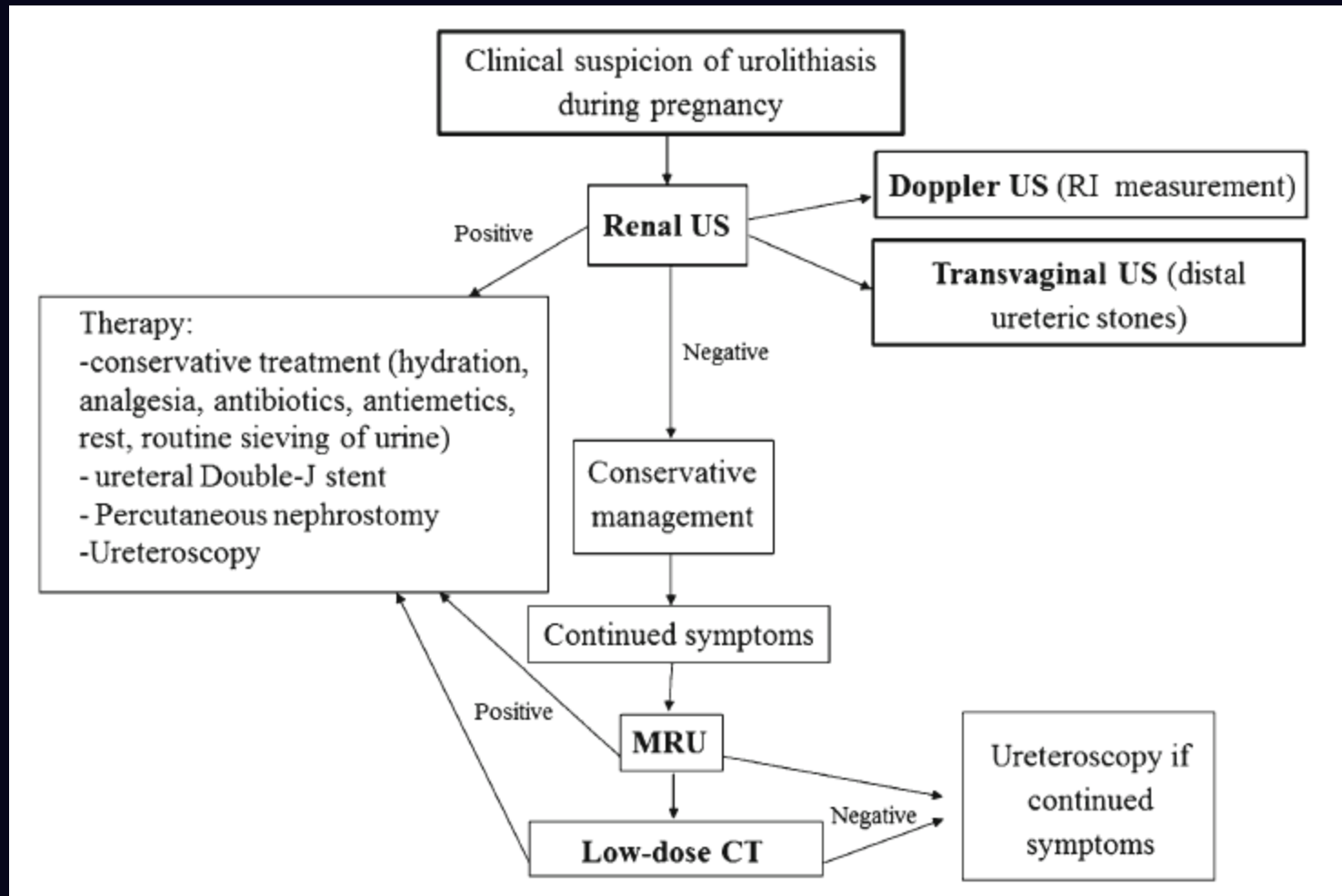
- Things to think about:
 - Iodinated contrast used in IVP can cross placenta, has free iodide (fetal thyroid).
 - No fetal effects ever reported.
 - Superimposition of fetal skeleton can obscure visualization of calculi.



CT

- Low dose and ultra low dose CT stone protocols have been developed.
 - Very low radiation dose comparable to the '3 shot' IVP.
 - Not fully evaluated in pregnant women, but small studies report 98% sensitivity and 95% specificity.

Algorithm for Imaging





4.

Pregnancy outcomes are
not really affected by
nephrolithiasis



Pregnancy Outcomes and Renal Stones

- Increased incidence of premature rupture of membranes in pregnancies complicated by renal stones.
- Other pregnancy complications such as preeclampsia, pregnancy loss are unaffected.



5.

Most patients will only need
conservative management



Management

- Most stones < 1cm will pass spontaneously.
- Rate of passage greater than general population likely due to pregnancy associated dilatation.
- Of stones that do not pass in pregnancy, half will pass after delivery.



Management

- Trial of passage with adequate pain management and aggressive hydration
 - Narcotics used for pain
 - NSAID's not safe for use in pregnancy
 - Alpha blockers like Tamsulosin (FDA category B for pregnancy safety) ok to use



Management

- Indications for aggressive approach:
 - Colic refractory to drug therapy
 - Sepsis/infection
 - Uncontrolled pain
 - Obstruction in single kidney
 - Renal dysfunction (normal creatinine low in pregnancy)
 - Preterm labor
 - Psychosocial reasons



Management

- More aggressive measures include:
 - Stents/ percutaneous nephrostomy tubes when temporary drainage is needed.
 - Both need frequent changes to minimize risk of encrustation.
 - Encrustation risk increased in pregnancy due to hypercalciuria, hyperuricosuria and elevated urine pH.
- Ureteroscopy / Surgery for more definitive treatment



Ureteroscopy

- Has been successfully employed throughout pregnancy, with no obstetric complications reported.
- May need GA, but has been performed with sedation only.
- Technically difficult in the third trimester.



Ureteroscopy

- Potentially easier in pregnant women because of smooth muscle dilatation.
- Performed under fluoroscopy or US guidance.
- High success rates reported, obviating the need for indwelling stent or nephrostomy tube.



Ureteroscopy

- Laser or pneumatic lithotripsy can be safely performed in pregnancy after ureteroscopic access obtained or stone can be retrieved with a stone basket.



Open Surgery

- Remains a viable alternative, especially in symptomatic septic patients where endourologic procedures have failed or are unavailable.
- Slight increased risk of preterm delivery.



Summary

- Despite changes in pregnancy conducive to stone formation, incidence of nephrolithiasis is not increased.
- USG is first-line imaging modality, but low dose CT or MRU may be reasonable alternatives.
- Most pregnant women respond to conservative measures.
- Stents, PCN, ureteroscopy may be performed safely in pregnancy.

Questions?



That's all Folks!