Association of Prior Pregnancy with 24-Hour Urine Composition and Stone Risk

Vivian Paredes Bhushan MS, Marie-Therese Valovska MD, Vernon M. Pais, Jr. MD

Geisel School of Medicine at Dartmouth | Dartmouth-Hitchcock Medical Center

Background

- Nephrolithiasis affects between 1/200 to 1/2000 pregnancies
- Pregnancy portends increased prevalence of calcium phosphate (CaPhos) nephrolithiasis
- Pregnancy-related urinary changes include hypercalciuria, alkaline urine

- **Aim:** To determine whether multigravidity is associated with long-term changes to urinary milieu and stone risk

Methods

- Retrospective single-center chart review of eligible stone-forming female patients with 24-hour urinalyses (Apr 2007 to Dec 2017)
- Prior pregnancies were assessed with a phone questionnaire (Jan 2018 to Sep 2019)
- Primary outcomes included 24h urine calcium, calcium phosphate supersaturation (SSCaP), and urinary pH
- Stones were categorized according to predominant crystal species, whether pure or mixed
- Likelihood of stone formation by category was then determined

Results

Table 1: Baseline characteristics of stone-forming nulligravid and previously gravid women

	Nulligravid	Previously gravid	*p*-value
No. of patients	22	94	
Mean age, years (SD)	53 (±13)	55 (±12)	0.63
Mean BMI kg/m^2, (SD)	34 (±9.9)	30 (±8.2)	0.086
Mean years since last pregnancy, (SD)	–	25 (±13)	–
% Obese*, (n)	68.2 (15)	43 (40)	0.030
% Diabetes, (n)	46 (10)	20 (19)	0.014

*defined as BMI ≥30 kg/m^2

Table 3: Effect of prior gravidity on odds of calcium phosphate nephrolithiasis by number of reported pregnancies

	Any % CaPhos*		> 50% CaPhos	
	OR (95%CI)	*p*-value	OR (95%CI)	*p*-value
All	0.41 (0.14 –1.2)	0.096	0.72 (0.23–2.3)	0.58
No. of Pregnancies				
0	Referent	–	Referent	–
1	2.8 (0.62 – 13)	0.18	0.98 (0.19 – 5.0)	0.98
2	1.1 (0.31 – 3.9)	0.88	1.3 (0.33 – 5.2)	0.70
3 or more	3.4 (1.1 – 10)	0.034	1.5 (0.45 – 5.2)	0.50

*Any % CaPhos defined as ≥10% in composition. Adjusted for age, BMI, and diabetes

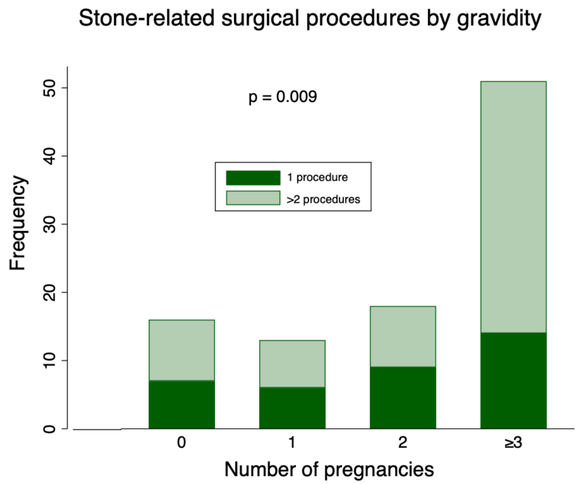

Figure 1: Stone-related surgical procedures by gravidity

Table 2: Effect of prior gravidity on 24-hour urine calcium (Ca24), calcium phosphate supersaturation (SSCaP), and urine pH, compared with nulligravids by number of reported pregnancies before and after adjustment

Unadjusted

	Mean Urine pH (95%CI)	*p*-value	Mean SSCaP (95%CI)	*p*-value	Mean Ca24 (mg/day) (95%CI)	*p*-value
All	6.1 (6.0 – 6.2)	0.081	1.3 (1.0 – 1.5)	0.069	208 (188 – 229)	0.020
No. of pregnancies						
0	5.8 (5.6 – 6.1)	–	0.82 (0.40 – 1.2)	–	153 (114 – 193)	–
1	6.2 (5.9 – 6.6)	0.087	1.3 (0.82-1.8)	0.11	191 (146 – 237)	0.20
2	6.0 (5.7 – 6.3)	0.38	0.95 (0.63 – 1.3)	0.62	210 (169 – 251)	0.047
3 or more	6.1 (6.0 – 6.3)	0.074	1.3 (1.1 – 1.7)	0.041	212 (183 – 241)	0.025

Adjusted

	Urine pH		SSCaP		Ca24 (mg/day)	
	ΔCoef. (95% CI)	*p*-value	ΔCoef. (95% CI)	*p*-value	ΔCoef. (95% CI)	*p*-value
All	-0.17 (-0.46 – 0.12)	0.25	-0.39 (-0.85 – 0.077)	0.10	-48 (-94 – -2.3)	0.040
No. of pregnancies						
0	Referent	–	Referent	–	Referent	–
1	0.34 (-0.066 – 0.75)	0.10	0.45 (-0.21 – 1.1)	0.18	43 (-23 – 108)	0.20
2	-0.0048 (-0.36 – 0.35)	0.98	0.096 (-0.48 – 0.67)	0.74	44 (-13 – 102)	0.13
3 or more	0.20 (-0.11 – 0.50)	0.20	0.49 (0.0018 – 0.98)	0.049	51 (2.3 – 100)	0.040

ΔCoef. : change in coefficient after adjusting for age, BMI, diabetes and urine volume

Conclusions & Future

- **Key points:**
  - Multigravid women were significantly more likely than nulligravids to exhibit hypercalciuria and elevated SSCaP even decades post-partum
  - G3+ women had significantly greater number of stone related surgical procedures, suggesting these changes are of clinical importance
  - Long-term effects on the urinary milieu likely exist
  - However, there was no proclivity in the formation of predominately CaPhos stones, suggesting that pregnancy is only one of many factors contributing to nephrolithiasis