

Urine Supersaturation Profile

CALCULATION OF BIOCHEMICAL RISK FOR FORMATION OF CALCIUM OXALATE, CALCIUM HYDROGEN PHOSPHATE, AND URIC ACID CALCULI

Test Highlights

- This test predicts formation of calcium oxalate, calcium hydrogen phosphate, and uric acid calculi using concentrations of analytes measured in a 24-hour urine specimen.
- Measured individual components and calculated supersaturation of stone-forming complexes are displayed graphically to depict relative risk for calculi formation.
- Test results are used in the evaluation and management of renal stone disease.

Disease Overview

- Urolithiasis is the diseased condition of forming calculi (stones) in the urinary tract. The majority of calculi found in developed countries are renal calculi or kidney stones.
- The mechanism for the formation of urine calculi has not been fully characterized; however, a number of factors have been determined that influence a patient's risk of urolithiasis.

Epidemiology

- Urolithiasis affects 5–10 percent of the population.
- Approximately 75 percent of calculi are composed of calcium oxalate or calcium combined with phosphate, urate, or mixtures of these components.

Pathophysiology

- Development of renal calculi is related to increased urine concentrations of stone-forming substances such as calcium, oxalate, urate, cystine, and xanthine. Low urine volume enhances urolithiasis.
- High concentrations of citrate and magnesium in the urine decrease the probability of stone formation.

Indications for Ordering

- Measurement of total volume and pH and quantification of calcium, magnesium, potassium, sodium, chloride, phosphate, sulfate, citrate, oxalate, urate, and creatinine in a 24-hour urine specimen provide a metabolic screen for evaluation of patients susceptible to urolithiasis.
- The Urine Supersaturation Profile provides calculated relative supersaturation indices for three common kidney stones.

Additional Ordering Notes

- This assay requires adjustment of urine pH (acidic, basic, and no alteration) and transport of four aliquots of urine from a 24-hour collection.
- Results from several samples collected both mid-week and weekends from outpatients pursuing their usual lifestyle

with respect to diet, fluid intake, and physical activity are of value in assessing propensity for urolithiasis. Urine should be collected at least six weeks after an episode of renal colic or urological intervention.

Interpretation

Analyte concentrations as a function of urolithiasis risk are plotted on the chart. Numbers at the far left and far right on each line of the chart provide a scale. Normal reference values fall in the middle of this scale. The values determined for this sample are placed on the scale to indicate the approximate risk associated with the particular concentrations. Increased risk is to the right of center; decreased risk, to the left. Relative supersaturation calculated for calcium oxalate, calcium hydrogen phosphate (brushite), and uric acid calculi is displayed in a second section of the chart. Relative risk increases from the middle to the right side of this chart.

Chart from Sample Report

URINE SUPERSATURATION INTERP		Interpreted Risk		Unit
Analyte		Reduced <:Nm1:>	:> Increased	
TV	4.0	:	:>>>>1.2	0.0 L/d
pH	7.0	<-6.50--:	:	4.0
Ca	0	135<----	:	400 mg/d
Mg	120	82<----	:	0 mg/d
Na	0	140<:	:	304 mmol/d
PO4	500	<-354-----:	:	1700 mg/d
SO4	0	12<-----:	:	42 mmol/d
Cit	1280	669<:	:	0 mg/d
Oxal	0	24<-----:	:	70 mg/d
urate	0	392<-----:	:	1400 mg/d
Other values				
K	46	mmol/d		
Creat	1220	mg/d		
Cl	182	mmol/d		
Relative Supersaturation				
		Reduced risk <:	:> Increased risk	
CaOx	0.0	4.66<--:	:	30.0
CaHPO4 (Brushite)	0.0	1.54<--:	:	4.0
uric Acid	0.6	0.17<--:	:	3.0

Limitations

- This profile does not include testing for urine cystine. If cystine calculi are suspected (calculi formation in relatively young individuals or family history of cystinuria), order [Cystine Quantitative, Urine \(0081106\)](#).
- Assessment for risk of magnesium ammonium phosphate (struvite) calculi is not included in this profile.

Methodology

- Chemical, physical, and spectroscopic techniques are used to assay urine components known to influence lithiasis.
- A computer program models the thermodynamics of calculi formation using measured urine components.
- The concentrations of complexed ions are determined by iterative calculations to determine the activity coefficients of the ions and, subsequently, the ratio of insoluble species to their saturated concentration or supersaturation.

Related Tests

Complete metabolic evaluation of individuals with stone disease may include measurement of plasma calcium, electrolytes, phosphate, urate, urea, creatinine, and parathyroid hormone in addition to urine testing.

References

1. Asplin J, Parks J, Lingeman J, Kahnoski R, Mardis H, Lacey S, Goldfarb D, Grasso M, Coe F. Supersaturation and stone composition in a network of dispersed treatment sites. *J Urol* 1998; 159:1821–5.
2. Marangella M, Petrarulo M, Daniele PG, Sammartano S. LithoRisk: a software for calculating and visualizing nephrolithiasis risk profiles. *G Ital Nefrol* 2002; 19(6):693–8.
3. Tiselius H-G. Medical evaluation of nephrolithiasis. *Endocrinol Metab Clin N Am* 2002; 31:1031–50.
4. Wilkinson H. Clinical investigation and management of patients with renal stones. *Ann Clin Biochem* 2001; 38:180–7.

Test Information

0081145

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For specific collection, transport, and testing information, refer to the ARUP Web site at www.aruplab.com.

For information on test selection, ordering, and interpretation, refer to ARUP Consult® at www.arupconsult.com.