





96n aumaes of prevention is worth a pound of cure!

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ALLEY AND ALLEY AL

Disclosures



SET GOALS

Describe who is at risk

2. Explain the chemistry

3. Review management/prevention



Who gets stones?





Epidemiology: Gender and Age

Characteristic	History of kidney s	stones, % (95% CI)	History of passing at least one kidney stone, % (95% Cl)		
	Male	Female	Male	Female	
Age group, yr					
20–29	3.4 (2.1-4.7)	3.4 (2.2-4.7)	3.3 (2.0-4.5)	2.5 (1.3-3.7)	
30–39	6.9 (5.0-8.8)	5.9 (4.5-7.2)	6.5 (4.6-8.5)	5.0 (3.5-6.4)	
40-49	9.8 (7.3-12.3)	7.6 (5.6–9.5)	8.1 (5.9-10.4)	6.4 (4.7-8.1)	
50–59	13.1 (10.3–15.9)	8.1 (5.9–10.3)	11.1 (13.4–19.3)	6.9 (4.8-9.0)	
60–69	19.1 (15.9-22.4)	9.4 (6.6-12.2)	16.3 (13.4–19.3)	8.4 (5.6-11.3)	
70+	18.8 (16.5-21.0)	9.4 (7.5-11.3)	16.0 (13.8-18.3)	7.1 (5.5-8.8)	
All ages	10.6 (9.4–11.9)	7.1 (6.4–7.8)	9.2 (8.1–10.3)	5.9 (5.2-6.6)	

CI = confidence interval.

Scales, CD et. al. EUROPEAN UROLOGY 62 (2012) 160-165



Epidemiology: Race

Characteristic	History of kidney stones, males		History of kidney stones, females		
	Unadjusted, % (95% CI)	Adjusted, % (95% CI)	Unadjusted, % (95% CI)	Adjusted, % (95% CI)	
All groups	10.6 (9.4–11.9)	10.3 (9.2–11.3)	7.1 (6.4–7.8)	6.7 (6.1-7.4)	
Non-Hispanic, white	12.8 (11.3-14.3)	11.8 (10.4–13.2)	7.9 (7.0-8.8)	7.5 (6.7-8.4)	
Hispanic	7.1 (5.7-8.4)	8.8 (7.4–10.2)	5.7 (4.6-6.9)	6.1 (4.9-7.3)	
Non-Hispanic, black	4.5 (3.4–5.6)	4.8 (3.7-5.9)	4.2 (2.7-5.7)	4.2 (2.8-5.6)	
Other race/multiracial	5.6 (2.5-8.8)	5.3 (2.2-8.5)	6.1 (2.7–9.6)	5.6 (2.4-8.8)	
CI = confidence interval.	Scales, (CD et. al. EUROPEAN UR	ROLOGY 62 (2012) 160-165		







Epidemiology: Diseases and Drugs













Epidemiology: Weight



Family History is Important



Increases your risk <u>3-fold</u>!

Recurrence is Likely!

- The chance of becoming a repeat stone-former:
 - 10% at 1 year
 - 35% at 5 years
 - 50% at 10 years







Epidemiology: USA



Epidemiology: Gender and Age



Epidemiology: Race

Characteristic	History of kidney	stones, males	History of kidney stones, females		
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Epidemiology: Weight



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How are stones formed?



The Chemistry of Stone Formation



The Chemistry of Stone Formation

Crystallization will occur

Metastable Range (this means crystallization is a maybe/maybe not)

Crystallization *will not/can not* occur Formation Product

Promoters favor maybe

Inhibitors favor maybe not

Solubility Product /Supersaturation Point







Heterogeneous Nucleation

Promoters favor maybe



Inhibitors favor maybe not











Classification of Kidney Stones





The Chemistry of Stone Formation



Heterogeneous Nucleation

• Promoters favor maybe



• Inhibitors favor maybe not



Classification of Kidney Stones



How are stones managed?



What We do when it Hurts! The "3Ps"



IV isotonic saline – pressure natriuresis NSAIDs – analsegic and smooth muscle relaxant +/- Alpha Blockers – ureteral dilatation Urologic Procedure – intractable pain



Infection \rightarrow Abx + Decompression (stent, nephrostomy) AKI \rightarrow Decompression (stent, nephrostomy) Admit and refer to Urology for stone removal



If unobstructed or obstructed, but not "plugged":
- Distal ureteral stone up to 10mm → Alpha Blocker
- For unpassed stone after 1-2 weeks → Urologic procedure
- For >10mm stone anywhere → Urologic evaluation







Stone-Former Age<18 Stone-Former with Family History

Recurrent Stone-Former

Metabolic Evaluation





Values larger, bolder and more towards red indicate increasing risk for kidney stone formation. See reverse for further details.

Stone Risk Factors / Cystine Screening: Negative (11/09/2005)

DATE	SAMPLE ID	Vol 24	SS CaOx	Ca 24	0x 24	Cit 24	SS CaP	pHq	SS UA	UA 24
03/31/09	5479898	4.65	2.63	326*	35	70	1.51	7:088	0.04	1.018
05/21/08	5371161	3.60	1.07	71	37	54	0.42	7.015	0.05	0.687
08/31/07	\$287506	3.17	1.63	93	41	47	0.63	7.278	0.03	0.626
03/29/07	\$251030	4.80	2.85	259	47	72	1.18	7.139	0.04	1.057
03/28/07	\$255170	4.90	3.10	342	45	73	1.56	7.0.37	0.04	0.919
11/05/05	5157418	4.44	3.23	289	46	67	1.57	Zalac	0.04	0.878
12/04/05	5157749	4.73	3.26	371	43	71	1.76	7.227	0.03	0.887
NORM	L RANGE	0.6 - 4L	6 10	male <250 female <200	20 - 40	male >450 female >550	0.5 - 2	5.8 - 6.2	0 - 1	male <0.800 female <0.750

Dietary Factors

DATE	SAMPLE ID	Na 24	K 24	Mg 24	P 24	Nh4 24	CI 24	Sul 24	UUN 24	PCR	
03/31/09	5479898	217	1.48	130	1.172	22	236	44	14.65	1.1	Ī
05/21/08	3371161	195	130	106	1.020	34	189	47	14.17	1.0	
09/31/07	S287606	182	118:	135	0.878	56	210	46	10.47	0.8	
03/29/07	\$251030	223	96	119	1.171	32	189	62	13.60	1.0	
03/28/07	\$255170	221	1.05	150	1.365	37	198	68	13.88	1.0	ļ
11/05/05	\$157418	214	128:	118	1.343	28	193	60	13.99	1.0	1
11/04/05	\$157749	236	113	164	1.221	26	222	59	12.66	0.9	
NORMA	L RANGE	50-150	20 - 100	30 - 120	0.6 - 1.2	15-60	70 - 250	20-80	6-14	0.8 - 1.4	









KIDNEY STONE









Prevention of Calcium Oxalate Stones



Prevention of Calcium Oxalate Stones













Prevention of Calcium Oxalate Stones



<u>Diet</u> Reduce Oxalate Intake (?)



24-h Urine Lithogenic Risk Profile	DASH (n = 21)	Low Oxalate (n = 20)	Point Estimate of Difference (95% CI)	<i>P</i> for Difference
Oxalate Baseline (mg/d) End of trial (mg/d) Change (mg/d)	49.1 ± 8.5 53.9 ± 14.0 4.8 (−1.8 to 11.4)	51.1 ± 12.5 47.0 ± 13.4 -4.2 (-12.4 to 4.0)	9.0 (-1.1 to 19.1)	0.08
Calcium oxalate supersaturation Baseline End of trial Change	7.16 ± 3.76 4.62 ± 3.11 -2.14 (-3.3 to -0.9)	6.28 ± 5.38 5.38 ± 2.10 −0.90 (−1.9 to 0.1)	-1.24 (-2.80 to 0.32)	0.08

Noori, N et.al. AJKD. 2014. 63(3):456-463

Weight-loss surgeries

The surgical technique known as banding promotes weight loss by restricting the amount of food a person can eat. The Roux-en-Y gastric bypass procedure works by restricting absorption of food in the intestines.

Banding

Rubber band is placed around the upper portion of the stomach to limit food consumption

Roux-en-Y gastric bypass

Surgeons staple off a large section of the stomach and reroute the intestine



Semins et. al. Urology, vol 76: 826-829, 2010.

Prevention of Calcium Oxalate Stones





Laerum, E and S Larsen. Acta Med Scand. 1984. 215:383-389

Prevention of Calcium Oxalate Stones UROCIT-**Blood stream Intestinal tract** Drugs **Thiazide Diuretics Potassium Citrate** Xanthine Oxidase Inhibitors





Pak CY, Fuller C. Ann Intern Med. 1986 Jan;104(1):33 7.



100 Tablets

Prevention of Calcium Oxalate Stones





A Quick Word About...



Calcium Kidney Stones and Osteoporosis





	Group 1	Group 2	Group 3	P Value
Creatinine clearance (mL/min)	99.86 ± 32.28	114.18 ± 45.27	102.94 ± 33.80	.06
Calciuria (mg/24 h)	187.34 ± 106.90	269.98 ± 119.49	207.06 ± 98.12	$.0001^{\dagger}$
Oxaluria (mg/24 h)	28.21 ± 17.65	$\textbf{29.83} \pm \textbf{24.41}$	$\textbf{22.11} \pm \textbf{16.49}$.06
Citraturia (mg/24 h)	1010.75 ± 647.83	537.72 ± 292.64	617.64 ± 315.86	$.0001^{\ddagger}$
Uricosuria (mg/24 h)	540.76 ± 186.20	587.24 ± 222.20	511.91 ± 167.06	.06
Calcium/creatinine 24 h	0.14 ± 0.06	0.18 ± 0.07	0.17 ± 0.07	.0001 [‡]
Calcium/citrate 24 h	0.22 ± 0.14	0.63 ± 0.46	0.56 ± 1.08	.001 [‡]
Phosphate tubular resorption 24 h	82.72 ± 6.96	81.24 ± 8.53	83.63 ± 4.82	.13
Fasting calcium (mg/dL)	9.58 ± 5.07	16.52 ± 8.76	15.14 ± 7.27	$.0001^{\ddagger}$
Fasting oxalate (mg/dL)	1.22 ± 0.69	1.48 ± 1.30	1.11 ± 0.68	.07
Fasting citrate (mg/dL)	50.82 ± 20.43	30.09 ± 15.04	42.32 ± 26.39	.0001*
Fasting uric (mg/dL)	36.65 ± 21.81	31.34 ± 12.70	34.57 ± 18.48	.22
Fasting calcium/creatinine	0.09 ± 0.03	0.16 ± 0.06	0.16 ± 0.05	$.0001^{\ddagger}$

Abbreviation as in Table 1.

* There are significant differences between groups 1 and 2, 2 and 3, and 1 and 3.

[†] There are significant differences between group 2 vs groups 1 and 3 but not between groups 1 and 3.

¹ There are significant differences between group 1 vs groups 2 and 3 but not between groups 2 and 3.

Arrabal-Polo , MA et.al. Urology. 85: 782-785, 2015

Kidney Stones and Bone Fracture



Melton LJ 3rd, et. al, KI, 1998 Feb;53(2):459-64.



Thiazides + Potassium Citrate on BMD of hypercalciuric kidney stone formers



Prevention of Uric Acid Stones





<u>Diet</u> Reduce Purine Intake (?)



Prevention of Uric Acid Stones







Pak, CY et.al. KI, Vol. 30 (1986), pp. 422-428

Prevention of Uric Acid Stones







Who Should Have a Metabolic Evaluation?



Stone-Former Age<18



Stone-

Former

Stone-Former with Family History



Metabolic Evaluation



DRINK!!!



Prevention of Calcium Oxalate Stones





Prevention of Uric Acid Stones





