CHALLENGING CASES IN THE MEDICAL AND SURGICAL MANAGEMENT OF UROLITHIASIS

SWIU 2009
THE PANELISTS

• **Amy Krambeck, M.D.**: Endourology Fellow, Department of Urology, The Methodist Hospital, Indianapolis, IN

• **Elspeth McDougall, M.D., FRCSC, MHPE**: Professor of Urology and Director Surgical Education Center, UC Irvine Medical Center, AUA Chair of the Office of Education

• **Kristina Penniston, Ph.D., R.D.**: Associate Scientist, Department of Urology, Univ. of Wisconsin School of Medicine and Public Health
“CHALLENGING CASES”

• Typically comprised of large, complex stones

• Also includes stones in patients:
  – With anatomically complex kidneys
  – With unusual body habitus
  – With relational anatomy to the kidney that makes the kidney inaccessible
  – With complicated medical history
  – At high risk for recurrence
posterior spleen

retrorenal colon
CASE 1

- A 53-yr-old woman with Crohn’s disease underwent multiple courses of SWL 15 and 10 years ago for multiple bilateral renal calculi
- Over the last 5 years she has experienced intermittent right flank pain and now has microhemeaturia
- IVP and CT were obtained. IVP is shown.
Case 1
Bilateral Simultaneous PCNL

Pre-op assess:
• Stone burden in each kidney
• Anatomy of collecting system,
• Renal Scan to determine differential function – treat better
  kidney first
• Sterile urine culture
• If 1\textsuperscript{st} side takes < 3 hours then do 2\textsuperscript{nd} side
Simultaneous Flexible Ureteroscopy & Percutaneous Access

Flexible Ureterorenoscopy
Prone - Head Down 20° Position
PCNL – Steps of the Procedure

1. Flexible ureteroscopy with access sheath
2. Fluoroscopic + ureteroscopic guided needle puncture of collecting system
3. Tract dilation – dilating balloon catheter
4. Nephroscopy & lithotripsy
5. Stent placement & nephrostomy removal
6. Foley catheter placement
11.5 F x 35 cm ureteral access sheath passed to the UPJ
THE INACCESSIBLE CALYX

Solution: DUAL ACCESS - Prone flexible URS
### Endoscopic vs Fluoroscopic PCNL: UCI Experience

<table>
<thead>
<tr>
<th></th>
<th>EndoPCNL</th>
<th>FluoroPCNL</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td># Pts</td>
<td>51</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Stone size</td>
<td>17 mm$^3$</td>
<td>16 mm$^3$</td>
<td>NS</td>
</tr>
<tr>
<td>No hydro</td>
<td>27%</td>
<td>12%</td>
<td>0.04</td>
</tr>
<tr>
<td>Supra costal</td>
<td>80%</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>EBL</td>
<td>158 ml</td>
<td>211 ml</td>
<td>0.03</td>
</tr>
<tr>
<td>Transfusions</td>
<td>7.8%</td>
<td>21.4%</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Similar BMI, age and ASA for the two groups
## Endoscopic vs Fluoroscopic PCNL

### UCI Experience

<table>
<thead>
<tr>
<th></th>
<th>EndoPCNL</th>
<th>FluoroPCNL</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OR Time</strong></td>
<td>+ 19 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chest Tube Postop</strong></td>
<td>3.9%</td>
<td>4.2%</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Stone Free ≤1mm</strong></td>
<td>35%</td>
<td>46%</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Sig Residual Fragment &gt;4mm</strong></td>
<td>31%</td>
<td>26%</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Avg Residual Fragment Size</strong></td>
<td>3.1 mm</td>
<td>3.8 mm</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Retreatment Rate</strong></td>
<td>24%</td>
<td>36%</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Similar BMI, age and ASA for the two groups
PCNL Complications - HEMORRHAGE
Post-op Management of PCNL Patients

• Indwelling ureteral stent + Foley catheter
• Non-contrast CT scan AM of 1st post-op day
• D/C Foley and discharge POD 1
• If residual stone then outpatient URS + HoL at 1 week
• If stone free then office stent removal at 1 week + 24 hr urine evaluation ordered
<table>
<thead>
<tr>
<th>Avg # of Pts</th>
<th>70 (Range 3 – 198)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean OR Time (mins)</td>
<td>107.6 (45 – 248)</td>
</tr>
<tr>
<td>Hgb Drop (gm/dl)</td>
<td>1.9 (1.6 – 2.4)</td>
</tr>
<tr>
<td>Transfusion Rate</td>
<td>9.4% (0 – 29%)</td>
</tr>
<tr>
<td>2nd Look Nephroscopy</td>
<td>9.9% (3 – 67%)</td>
</tr>
<tr>
<td>Mean Length of Stay</td>
<td>5 days (2.5 – 6.6)</td>
</tr>
<tr>
<td>Stone Free Rate (KUB)</td>
<td>90% (75 – 100%)</td>
</tr>
</tbody>
</table>
# Synchronous Bilateral PCNL: Analysis of Clinical Outcomes, Cost & Reimbursement

A Bagrodia et al: J Urol 2009; 181: 149

<table>
<thead>
<tr>
<th></th>
<th>Bilateral Synchronous PCNL</th>
<th>Unilateral Staged PCNL</th>
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</thead>
<tbody>
<tr>
<td><strong># of Patients</strong></td>
<td>15</td>
<td>62</td>
</tr>
<tr>
<td><strong>Stonefree Rate / 2\textsuperscript{nd} Look Nephroscopy</strong></td>
<td>73%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Mean OR Time (mins)</strong></td>
<td>354</td>
<td>477</td>
</tr>
<tr>
<td><strong>Length of Stay (days)</strong></td>
<td>3.1</td>
<td>6.3</td>
</tr>
<tr>
<td><strong>Transfusion Rate</strong></td>
<td>0</td>
<td>4.7%</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td>↓ ($275 – 1000)</td>
<td>↑ ($4 – 5000)</td>
</tr>
<tr>
<td><strong>Surgeon Reimburse</strong></td>
<td>↓</td>
<td>↑</td>
</tr>
</tbody>
</table>
A Fine Balance
The Management of the PCNL Patient
After surgical treatment of her stones, a 24-hour urine collection is obtained. Treatment should consist of:

<p>| | | |</p>
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<tbody>
<tr>
<td>TV</td>
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<td></td>
</tr>
<tr>
<td>pH</td>
<td>5.25</td>
<td></td>
</tr>
<tr>
<td>Ca</td>
<td>50</td>
<td>nl (&lt;200 mg/d)</td>
</tr>
<tr>
<td>Oxalate</td>
<td>80</td>
<td>nl (&lt;40 mg/d)</td>
</tr>
<tr>
<td>Citrate</td>
<td>15</td>
<td>nl &gt;320 mg/d</td>
</tr>
<tr>
<td>Sodium</td>
<td>65</td>
<td>nl (&lt;200 mEq/d)</td>
</tr>
<tr>
<td>Uric acid</td>
<td>510</td>
<td>nl (&lt;600 mg/d)</td>
</tr>
</tbody>
</table>
Crohns and Stones

- Risk of: CaOx, CaPhos, ammonium urate stones
  - Chronic diarrhea
    - Malabsorption of calcium and magnesium
      - Ca\(^{++}\) & Mg\(^{++}\) malabsorption: ↑oxalate absorption
      - Mg\(^{++}\) malabsorption: ↓inhibitory potential for CaOx stones
    - Bicarbonate wasting
      - Acid urine
      - Hypocitraturia
    - Excessive fluid losses
      - Increased urine supersaturation
  - Depletion of oxalate-degrading bacteria in GI tract
    - Increased colonic permeability to oxalate with exposure of mucosa to excess bile salts

KL Penniston, PhD, RD

24-h urine profile from a patient with Crohn’s disease and a h/o stones

Common features: high oxalate, low urinary calcium, low citrate, low TV

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Crohns – Manage Diarrhea

- Increase dietary fiber intake
  - Both soluble and non-soluble fiber recommended
  - Use fiber supplements if necessary
- Limit dietary fat and fried foods
- Limit dietary lactose if lactose intolerant
- Pancreatic enzymes?
- Probiotics & prebiotics *(effects on diarrhea recently reviewed by de Vrese & Marteau, J Nutr 2007;137:803S-811S)*
  - Enhanced colonization of gut microflora that ferment fibers and carbohydrates not digested in upper GI tract
  - Increased synthesis of fatty acids that support a healthy intestinal barrier (particularly in the lower GI tract)
Probiotic and Prebiotic Sources

Examples

<table>
<thead>
<tr>
<th>CLASS/ COMPONENT</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probiotics</strong></td>
<td></td>
</tr>
<tr>
<td>Certain species &amp; strains of <em>Lactobacilli, Bifidobacteria, Yeast</em></td>
<td>Certain yogurts, other cultured dairy products and non-dairy formulations</td>
</tr>
<tr>
<td><strong>Prebiotics</strong></td>
<td></td>
</tr>
<tr>
<td>Inulin, fructo-oligosaccharides (FOS), polydextrose, arabinogalactan, polyols (lactulose, lactitol)</td>
<td>Whole grains, onions, garlic, bananas, honey, leeks, artichokes, fortified foods &amp; beverages, dietary supplements</td>
</tr>
</tbody>
</table>

Crohns - Manage Hyperoxaluria

– Optimize dietary calcium intake
  • From foods as tolerated; supplements probably needed
  • Time intake with meals and other eating occasions

– Reduce dietary oxalate (and oxalate from supplements) if indicated
  • Efficacy, however, is questionable as increased endogenous production and a low calcium intake are considered primary causes [Siener et al, Kidney Int 2003;63:1037-43]

– Eliminate exogenous effectors of oxalate biosynthesis
  • Supplements, foods

– Bile acid binders may work in some cases

– Probiotic supplementation ... strong evidence lacking

– Pyridoxine supplementation ... evidence lacking

KL Penniston, PhD, RD
Crohn’s - Manage Hypocitraturia

– Pharmacologic therapy

– Reduce dietary potential renal acid load (PRAL)
  - Foods with highest (+) PRAL are meat, fish, poultry, cheese
  - Foods with net negative PRAL are most all fruits and most all vegetables
    - Milk and yogurt are net neutral

– Enhance exogenous citrate intake
  - Kang et al, J Urol 2007;177:1358-62
  - Penniston et al, Urology 2007;70:856-60
  - Touhami et al, BMC Urol 2007;7:18 (rats)

Negative results:
- Koff et al, Urology 2007;69:1013-6
Crohns – Maximize Inhibition

- Fluids appropriate to offset stool losses and to maintain suitably low urine supersaturation
  - Distributed throughout the day
  - Low-sugar, low-calorie beverages recommended
- Magnesium supplementation, if Mg status is low
- Ample antioxidant intake
  - Food sources
  - Supplements (vit. E, vit. C, bioflavonoids...??)
- Reduce stress
  - Diniz et al, J Urol 2006;176:2483-7

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CASE 2

- A 55-yr-old man with recently diagnosed T1c prostate cancer underwent a planning CT in anticipation of XRT
- He is otherwise healthy and has no personal or family history of stones
- How would you proceed?
Surgical Treatment Options

- Based on stone location and size
  - SWL
  - Ureteroscopy
  - Percutaneous nephrolithotomy

- Other considerations
  - Composition
  - Stone attenuation (HU)
  - Skin to stone distance (SSD)
Stone Composition

• Not an issue for PCNL and ureteroscopy
  – Ultrasound and/or holmium laser capable of fragmenting all stone compositions

• SWL low success rate
  – Cystine
  – Brushite
  – Calcium oxalate monohydrate
Stone Attenuation

• 30 patients treated with SWL
  – Success rate significantly lower for SA >1000 HU\(^1\)

• 120 patients undergoing SWL
  – Success rate 87.5%
  – Stone density > 1000 HU associated with SWL failure\(^1\)

Skin to Stone Distance

• 64 patients treated with SWL$^3$
  – SSD center of stone to skin edge
  – >10 cm SSD associated with SWL failure

• Multivariate analysis for SWL failure risk factors:
  – stone composition
  – SSD
  – SA

• < 900 HU & < 9 cm SSD
  – SWL success independent of stone size, location and BMI

FACTORS PREDICTING SWL SUCCESS

Risk Stratification
“Success rates”

- <900 HU, SSD <9 cm: 91%
- <900 HU, SSD ≥9 cm: 79%
- ≥900 HU, SSD <9 cm: 58%
- ≥900 HU, SSD ≥9 cm: 41%
FACTORS PREDICTING SWL SUCCESS

Risk Stratification
“Success rates”

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FACTORS PREDICTING SWL SUCCESS


Risk Stratification

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- <900 HU, SSD ≥9 cm: 79%
- ≥900 HU, SSD <9 cm: 58%
- ≥900 HU, SSD ≥9 cm: 41%
• Serum chemistries, including creatinine, potassium, bicarbonate, calcium, phosphorus, uric acid and iPTH were normal. 24-hour urine is shown. Recommended treatment should consist of:

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<td>6.1</td>
</tr>
<tr>
<td>Ca</td>
<td>330 nl (&lt;200 mg/d)</td>
</tr>
<tr>
<td>Oxalate</td>
<td>38 nl (&lt;40 mg/d)</td>
</tr>
<tr>
<td>Citrate</td>
<td>600 nl &gt;320 mg/d)</td>
</tr>
<tr>
<td>Sodium</td>
<td>299 nl (&lt;200 mEq/d)</td>
</tr>
<tr>
<td>Uric acid</td>
<td>850 nl (&lt;600 mg/d)</td>
</tr>
</tbody>
</table>
Calcium Oxalate Stone Disease

- Often no single risk factor
- Nutrition and pharmacologic therapy is tailored to individual risk factor(s)
  - Frequently, these include:
    - Idiopathic hypercalciuria
      - Hypernatriuria
      - High dietary acid load
      - High (refined) carbohydrate intake
      - Low fiber intake
    - Hyperuricosuria
    - Overweight/obesity
CaOx Stones - Hypercalciuria

- Pharmacologic therapy
- Reduce dietary salt (NaCl) intake
- Reduce PRAL of diet
- Increase dietary fiber intake
- Ensure optimal calcium intake
  - To regulate GI oxalate absorption, esp. if hyperoxaluric
- Reduce body mass if overweight
- Fish oil supplementation ... *evidence from RCTs lacking*
- Recommend treatment, if necessary, for other contributors to hypercalciuria:
  - Excessive bone resorption, hyperparathyroidism, sarcoidosis

*KL Penniston, PhD, RD*
CaOx Stones - Hyperuricosuria

• Pharmacologic therapy
• Reduce dietary effectors of uric acid biosynthesis
  – Beef, pork, fish, seafood, poultry
    • Note that low-fat dairy is NOT included here
  – High-purine foods
    • Mussels, scallops, herring, anchovies, sardines, mackerel, meat extracts & broths, organ meats, sweetbreads (edible glands of an animal), wild game, gravy
    – Fructose
    – Alcohol
• Reduce PRAL of diet
• Reduce body mass if overweight

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CaOx Stones - Hypernatriuria

- Na⁺ increases urinary calcium excretion and decreases efficacy of thiazide diuretics
- Must employ dietary strategies
  - Salt shaker contributes only ~10% of dietary Na⁺
  - Salt sources are rampant in our food supply:
    - Cheese
    - Salty snacks (chips, popcorn, pretzels, crackers, nuts, seeds)
    - Processed/ packaged foods & entrees, convenience foods
    - Baked goods (including breads...)
    - Sauces, dressings, condiments, spice blends
    - Canned vegetables and soups
    - Restaurant foods
    - Sports beverages

Some European nations are legislating the use of salt in food manufacturing & processing

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Salt Facts

• DRI for Na⁺ is 1,500 mg/d
• AHA recommends <2,300 mg/d
• UL for Na⁺ is 2,300 mg/d
• Most Americans eat 5,000-6,000 mg Na⁺/d
• Risk cutoff for 24-h Na⁺ excretion is 200 mEq (4,600 mg)

• 1 tsp. salt, 2,325 mg
• 1 tsp. baking soda, 1,000 mg
• 1 Tbsp. soy sauce, 1,000 mg
• Fast foods:
  – 6” Subway sandwich
    • Cold cut trio, 1730 mg
    • Tuna, 1190 mg
    • Sweet onion chicken teriyaki, 1090 mg
  – Culver’s
    • Taco salad with shell, 1643 mg
    • Grilled chicken cashew salad, 1369 mg
    • Butter burger with cheese, 1207 mg
  – Pizza Hut
    • Thin crust, cheese only, 1 sl, 600 mg
    • Hand tossed-style crust, “Supreme,” 1 sl, 730 mg

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CaOx Stones – Crystal Inhibition

• Increase fruit and vegetable intake
  – Provides dietary alkaline load, K⁺, Mg, fiber, phytate, citric acid and antioxidants
    • All of which inhibit stone formation by various mechanisms
• Increase fluid intake, distributed throughout the day
• Optimize/ increase urinary citrate excretion
• Optimize/ increase urine pH to prevent uric acid nidus for CaOx crystal formation

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CASE 3

• A 60-year-old man without previous history of stones noticed tea-colored urine on several occasions
• Subsequently, he has had occasional left flank pain
• Office cysto was negative
• CT and IVP were obtained
Case 3 – Calyceal Diverticulum with Stone

Approach to management

• Observation

• Retrograde ureterorenoscopy

• Antegrade PCNL

• ESWL

• Laparoscopic diverticulectomy
### ESWL Treatment of Caliceal Diverticula


<table>
<thead>
<tr>
<th>Stone Free Rate</th>
<th>21% (13 – 58%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom Free Rate</td>
<td>68% (56 – 86%)</td>
</tr>
</tbody>
</table>

SWL for calyceal diverticula and stones is reserved for relatively small stone burden and radiographically patent diverticular neck.
Calyceal Diverticulum with Stone
Retrograde Ureterorenoscopy

- Retrograde ureterorenoscopy
- Identify ostium to diverticulum
- Laser incision into diverticulum
- Remove stone(s)
- Laser fulgurate the diverticulum
- Ureteral stent

Images from Matsumoto’s chapter 14 in Advanced Endourology
## Retrograde Treatment of Caliceal Diverticula


<table>
<thead>
<tr>
<th>Overall Total Patients</th>
<th>191</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successful entry into tic</td>
<td>88%</td>
</tr>
<tr>
<td>Stone Free Rate</td>
<td>78%</td>
</tr>
<tr>
<td>Symptom Free Rate</td>
<td>79%</td>
</tr>
<tr>
<td>Complications</td>
<td>9%</td>
</tr>
<tr>
<td>Follow-up (mos)</td>
<td>1 – 84</td>
</tr>
</tbody>
</table>
Calyceal Diverticulum with Stone
Antegrade Percutaneous Diverticulectomy

• Ureterorenoscopy visualized PCN access
• PCNL removal of stone(s)
• Incision of ostium & fulguration of diverticulum
• Nephrostomy (Cope loop) + ureteral stent
Antegrade Treatment of Caliceal Diverticula
E Matsumoto & M Pearle: Advanced Endourology,
S Nakada & M Pearle (eds): 2006, pp229 - 249

<table>
<thead>
<tr>
<th>Overall Total Patients</th>
<th>256</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone Free Rate</td>
<td>89%</td>
</tr>
<tr>
<td>Symptom Free Rate</td>
<td>89%</td>
</tr>
<tr>
<td>Obliteration of tic</td>
<td>60%</td>
</tr>
<tr>
<td>Complications</td>
<td>15%</td>
</tr>
<tr>
<td>Follow-up (mos)</td>
<td>25 (18 – 96)</td>
</tr>
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</table>
Calyceal Diverticulum with Stone
Laparoscopic Diverticulectomy

<p>| | |</p>
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td># of Patients</td>
<td>7</td>
</tr>
<tr>
<td>OR Time</td>
<td>80 Mins</td>
</tr>
<tr>
<td>Hospital Stay</td>
<td>3 – 6.6 days</td>
</tr>
<tr>
<td>Stone Free Rate</td>
<td>100%</td>
</tr>
<tr>
<td>Complications</td>
<td>Urine leak (1) Transfusion (1)</td>
</tr>
</tbody>
</table>

Best reserved for patients with very superficial diverticula who have failed alternate approaches.
After undergoing PCNL with dilation of the diverticular neck and fulguration of the diverticular cavity, the patient is asymptomatic and stone free.

- He has no family history of stone disease.
- Serum chemistries reveal a normal serum creatinine, potassium, bicarbonate, calcium, phosphorus, uric acid and iPTH.

Should the patient be evaluated metabolically and if so what would you expect to find?
Metabolic Evaluation for Caliceal Diverticulum

• Metabolic abnormality in 25-100% of caliceal diverticula patients\textsuperscript{1-3}

• Matlaga et al\textsuperscript{4}
  – 29 Tic vs. 245 CaOx vs. 162 normal patients
  – Tic & CaOx patients similar stone risk parameters
  • Hypercalciuria and high CaOx SS

Stasis vs. Metabolic Abnormality

• 3 patients diverticular urine aspiration
• CaOx SS lower in diverticular urine than renal pelvis urine

• Hypothesis:
  – Urine stasis allows ppt of CaOx from urine to form stone thus lowering SS

• Most likely both stasis and metabolic abnormalities contribute to stone formation
CASE 4

• A 36-year-old woman with a history of stones has recurrent bilateral flank pain
• She occasionally passes stones, but frequently requires ER visits for pain
• She desires surgical intervention to clear the stones
• KUB and representative CT images are shown
• Would you agree to surgery and what procedure would you recommend?
To Treat or Not to Treat

- Nonmobile caliceal stones can cause pain
- 26 patients treated\(^1\)
  - 10 SWL
  - 15 PCNL
  - 1 open surgery (1988)
- 25/26 had complete resolution of their pain

To Treat or Not to Treat

- 3 institutions retrospective review 1999-2008
- Ureteroscopic laser endopapillotomy
- 65 patients 176 procedures
- 82.8% significantly less pain or no pain
- Mean duration of resolution 26.2 months
- 60% had >1 year symptom relief
- No change in GFR from preop to follow-up

Ureteroscopy

- Access sheath
- Pressurized irrigant
- Holmium laser
- Unroof submucosal stones
- Basket large fragments
- Stent for 72 hours
- Expect stent pain 8%
• After ureteroscopy and stone removal, she is stone free. Stone analysis reveals 90% CaAp and 10% CaOx(m)

• She has a hx of frequent migraine headaches resistant to most medications except Topamax which she takes at 50 mg BID

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<tr>
<td>Sodium</td>
<td>175</td>
<td>nl (&lt;200 mEq/d)</td>
</tr>
<tr>
<td>Uric acid</td>
<td>475</td>
<td>nl (&lt;600 mg/d)</td>
</tr>
</tbody>
</table>
Topamax (Topiramate)

• Antiepileptic drug
  – Increasingly used for migraines and for weight loss
    • If predictions of increased use for weight loss are true, we will need to get a handle on the medical management of side effects with respect to lithogenic risk!

• Associated with a kidney stone in 1.5% of patients in published clinical trials
  – But... risk may be under-reported
    • 13 of 24 (54%) individuals on topiramate monotherapy or polytherapy developed clinical evidence of urolithiasis after a mean duration of 36.4 months
Topamax and Stones

• Underlying abnormality is renal tubular acidosis
  – Inhibition of carbonic anhydrase in the proximal and distal renal tubules
    – Profoundly low urinary citrate, high urine pH, high urine HCO$_3$\text{−}$, high urine brushite saturation, no change in urine Ca$^{++}$, low serum HCO$_3$ & K$^+$
      » Unexpected finding in one trial was a lower urinary oxalate concentration
    – Calcium apatite is major crystal moiety formed
                   Kuo et al, J Endourol 2002;16:229-31
                   Wasserstein et al, Epilepsia 1995;36(suppl 3):153
Topamax - Medical Management

- Patients reluctant to stop therapy
- So must treat metabolic side effects/ risk factors
  - Hypocitraturia
    - Potassium citrate?
      - No studies... *Need to weigh benefit against risk of* ↑ urine pH
    - Increase dietary alkaline load (K⁺ sources) and dietary citrate
      - No studies...
  - High urine pH
    - Acidify urine, e.g., with ascorbic acid?
      - No studies... *Need to weigh benefit with risk of higher oxalate*
  - High brushite saturation in urine
    - Push fluids

KL Penniston, PhD, RD
CASE 5

- A 63-year-old man with Type II DM, hypercholesterolemia and HTN has mild intermittent left flank pain
- UA revealed microhematuria
- Cystoscopy was negative
- IVP and CT were obtained
Case 5
Diabetic with Radiolucent Renal Calculi

Pre-op assess:
- Stone burden in each kidney by CT scan
- Anatomy of collecting system by CT IVP / RGP
- Renal Scan to determine differential renal function
- Sterile urine culture
- Admit day pre-op for IV antibiotics
Simultaneous Flexible Ureteroscopy & Percutaneous Access

Flexible Ureterorenoscopy
Prone - Head Down 20° Position
PCNL – Steps of the Procedure

1. Flexible ureteroscopy with access sheath
2. Fluoroscopic + ureteroscopic guided needle puncture of collecting system
3. Tract dilation – dilating balloon catheter
4. Nephroscopy & lithotripsy
5. Stent placement & nephrostomy removal
6. Foley catheter placement
"11.5 F x 35 cm ureteral access sheath passed to the UPJ"
After treatment of his stone, a 24-hour urine specimen was collected.

What treatment should be recommended?

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>TV</td>
<td>1.75L</td>
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<tr>
<td>pH</td>
<td>5.15</td>
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<tr>
<td>Ca</td>
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<tr>
<td>Oxalate</td>
<td>37</td>
<td>nl (&lt;40 mg/d)</td>
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<tr>
<td>Citrate</td>
<td>495</td>
<td>nl &gt;320 mg/d)</td>
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<tr>
<td>Sodium</td>
<td>175</td>
<td>nl (&lt;200 mEq/d)</td>
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<tr>
<td>Uric acid</td>
<td>235</td>
<td>nl (&lt;600 mg/d)</td>
</tr>
</tbody>
</table>
UA Stones and Metabolic Syndrome

• + association between obesity, urine pH, & UA SS\textsuperscript{1}

• Insulin necessary for renal production of ammonia\textsuperscript{2,3}

1. Taylor and Curhan 2006
3. Chobanian and Hammerman 1987
Metabolic Treatment

• Potassium citrate and fluids

• Watch CaP & CaOx SS
  – urine calcium is high
  – May need thiazides in future base on stone type

• Allopurinol
  – May be beneficial if concurrent gouty diathesis
  – Not necessary if not hyperurocosuric\(^1\)

• Expect urine UA levels to rise with alkaline therapy

• Follow with CT

CONCLUSIONS
Selection of Optimal Treatment

• Surgical Management
  – Accurate estimation of stone burden
  – Determination of intrarenal anatomy
  – Assessment of relational anatomy of the kidney

• Medical Management
  – Comprehensive management of stone formers does not stop at surgical removal
  – Identify pts w/ risk factors for stone formation
  – Evaluate high risk pts