Renal and Ureteral Calculi Management and Updates

Folusho Ogunfiditimi DM, MPH, PAC
Administrative Director,
Adult Clinical Services and Advanced
Practice Provider,
DMC Urology
Objectives

- Describe the risk factors and causes of Renal and Ureteral Calculi
- Identify the various types of Renal and Ureteral Calculi
- Demonstrate the medical and surgical treatment of Renal and Ureteral Calculi
- Highlight the complications related to various Renal Calculi
- Discuss the role of PAs in Stone management
Etiology

- Pure causes are unknown
- Risk Factors are well defined
  - Hypercalciuria
  - Hyperparathyroidism
  - Hypercalcemia
  - Primary Hyperoxaluria
Epidemiology

- 12% Men, 5% Women
- Increasing prevalence
- 1 in 11 people, 50% reoccurrence
- Composition of stones well known
- Causes are still uncertain
- Urinary Supersaturating (SS)
- 24h urine test and urine pH
- Crystals can start to form with SS levels >1
Types of Renal/Ureteral Calculi

- Calcium Oxalates/Phosphates
  - Most common
  - Radiopaque
- Uric Acid Calculi
  - Uric Acid levels
  - Most are radiolucent
- Cysteine Calculi
  - Cystinuria
  - Rare and more radiolucent than opaque
  - Resistant to SWL
- Staghorn Calculi
Calcium Oxalate Stones

- Most common stones
- Patient with Plaque disease (Randall’s Plaque)
- Propensity for UTI
- Hypercalciuria
- Low urine pH
- Obesity
Calcium Oxalate stones

Figure 1

Figure 2
Uric Acid Stones

- >90% radiolucent
- SWL of little value
- Medical therapy with
  - K–Citrate or Na–Citrate is mainstay
- Alkalize the urine
- UA levels, low urine pH
- Risk of Gout
Cysteine Stone

- Cystinuria
- Rare
- More radiolucent than opaque
- Resistant to SWL
- Increased risk of Renal Failure

Excess of cystine in urine causes cystine stones
Staghorn stones

- Branched Stones within the collecting system calices
- Mixture of Ammonium phos and calcium carbonate
- Untreated results in Severe sepsis and kidney disease
S/Sx

- Hx of Calculi
- Family Hx of Calculi
- Renal Colic – Severe Flank Pain
- Nausea/Vomiting – systemic
- Fever/Chills – r/o Sepsis
  - Lactate Acid Levels
Differential

- Urinary Tract Infections
- Appendicitis
- Diverticulitis
- Acute Back Pain
Diagnosis

- **History**
  - Detailed
  - Dietary hx is important
  - Kidney stone pain is related to acute obstruction

- **Physical**
  - Flank Tenderness

- **Ancillary Testing**
  - UA/UCS
  - Uric Acid Levels
  - Serum Creatinine – should be normal
  - Imaging
Imaging

- **KUB**
  - Radiolucent
  - Radiopaque

- **RUS**
  - Hydronephrosis
  - Ureteronephrosis

- **IVP**

- Abdominal CT scan (non contrast)
  - Gold Standard
Renal stones
Proximal Ureteral stone
Imaging

- Abdominal CT – Gold standard
  - Non Contrast
- Pyelogram – Antegrade vs. Retrograde
- Cystoscopy
3D imaging
Management and Treatment

- Goals of treatment
  - Pain relief/ Emergency Management
  - Definitive treatment

- Stone stratification
  - Stone Location (Renal, Proximal, mid or distal)
  - Stone size (\(\leq 5\text{mm}, >5\text{mm}, \leq 10\text{mm}, >10\text{mm}\))

- Observation and Medical Explusive Therapy

- Surgical
  - Endoscopic and Extracorporeal
  - Percutaneous and Open
Observation and MET

- Observation
  - Stones $\leq 5$mm
    - No ureteral Obstruction, No pain
    - 68% spontaneous expulsion rate
  - Stones $> 5$mm, $< 10$mm
    - 47% spontaneous expulsion rate

- Medical Expulsive Therapy
  - Alpha Blockers – 81% (Preferred agent)
  - Calcium Channel Blockers – 71%

- Dietary Modifications
  - 2.5 liters of water per day

AUA, 2007
Extracorporeal Shock wave Lithotripsy (ESWL)

- Primary surgical treatment of Renal/Ureteral stones
- The only non invasive surgical management of renal and ureteral stones
- Approved in 1980
- Series of shockwaves delivered through a lithotripter
- Success is influenced by stone size, location and patient body habitus etc.
ESWL
video

https://www.youtube.com/watch?feature=player_detailpage&v=GwQBpp3KiPc
Ureteroscopy/Stone Basketing/Laser lithotripsy

- First Line surgical therapy
- Flexible or rigid scope through the ureter
- Basket deployment to capture the stone
- 100% clearance if successful
- Laser to fracture large stone
- +/- Ureteral stent
URS video

https://www.youtube.com/watch?feature=player_detailpage&v=u9O-kKSxKi0
<table>
<thead>
<tr>
<th>Overall Population</th>
<th>AUA / EAU Ureteral Stones Guideline Panel</th>
<th>Stone Free Rate - Primary Treatments or First Treatment</th>
<th>SWL</th>
<th>URS</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>G/P</td>
<td>Med / 95% CI</td>
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<tr>
<td>Distal Ureter</td>
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<td></td>
<td>50</td>
<td>74% (73 - 75)%*</td>
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<td>Distal ureter &lt; 10 mm</td>
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<td>1684</td>
<td>(80 - 91)%</td>
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<tr>
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<td>74%</td>
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<td></td>
<td></td>
<td>966</td>
<td>(57 - 87)%</td>
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<tr>
<td>Mid Ureter</td>
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<td>73%</td>
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<td>1607</td>
<td>(66 - 79)%</td>
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<td>Mid ureter &lt; 10 mm</td>
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<td>44</td>
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<td>Mid ureter &gt; 10 mm</td>
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<td>Proximal Ureter</td>
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<td>Proximal ureter &lt; 10 mm</td>
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<td>Proximal ureter &gt; 10 mm</td>
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<td>68%</td>
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<td>293</td>
<td>(55 - 79)%</td>
</tr>
</tbody>
</table>

G = Number of Groups/Treatment arms extracted;  P = Number of Patients in those groups
PCNL

- More surgically invasive
- Reserved for Complex stones like staghorn
- Open or Robotic approach
- Stones > 1.5cm
Staghorn Calculi

- Complex management Strategies
  - Requires multiple approach
  - Goal is Renal Protection
Video

- https://www.youtube.com/watch?feature=player_detailpage&v=BCzxODuF3R8
- https://www.youtube.com/watch?feature=player_detailpage&v=_Sk4MDsbukg
Renal Calculi and Comorbidities

- Pregnancy
  - Renal colic is the most common non OB cause of pain during pregnancy
  - Deliver, Deliver, and then Deliver
  - Pain Relief
  - US or limited IVP
  - Surgery – Ureteral Stenting or PCN

- Sepsis
  - Fluids, Abx,
  - Surgery

- Acute Renal Failure
Role of PA

- Medical Assessment / and treatment
- Counseling and education
- Diagnosing and Ancillary testing
- Emergent consults and management
- Pre op and Post Op management
- First Assist – Robotic Pyelolitotomy
- Cystoscopy and Stent removals
Questions
References

- www.natural-homeremediaes.org
- www.aafp.org
- https://www.stonedisease.org/kidney-stone-photos
- http://intranet.tdmu.edu.ua/data/kafedra/internal/endoskop_fpo/classes_stud/en/med/lik/ptn/urology/4%20year/Lesson%203.htm

*http://urology.jhu.edu/MIS/ESWL.php