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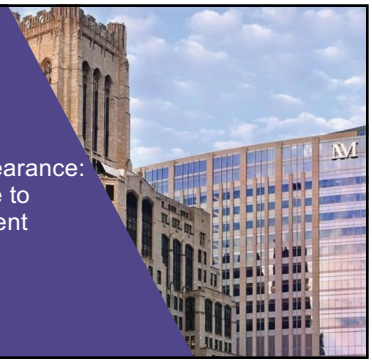

From Colic to Clearance: A Practical Guide to Stone Management

Jeremy Lai, MD MBA
NMG Department of Urology
March 14, 2026

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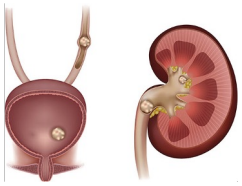
How does this matter to you?

- Nurses come first!
  - First contact for patients and symptoms
  - First contact for setting expectations
  - First contact for post procedural questions
- Goals
  - Help us understand stones
  - Help patients understand their symptoms, treatment goals, and prevention



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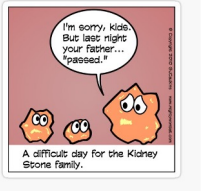
Introduction

Outline

- Epidemiology - Why do stones matter?
- Diagnosis - How do we find stones?
- Management
  - Medical treatment
  - Surgical treatment
  - Patient expectations
- Follow-up - How do we prevent future stones?
- Conclusion - What are the key takeaways?



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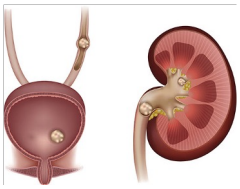
Definitions

What are we talking about?

- Stones can form anywhere in the urinary tract
- We will focus specifically on nephrolithiasis



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Epidemiology

Why we are, and will continue to be, busy!

- Kidney stones are happening more, to more patients
  - 11% of Americans will have a stone
  - 70% increase in stone prevalence from 1994 to 2015
- Risk factors include: age, male sex, metabolic syndrome, immobility
  - Peak incidence appears in working age, ages 40-54
  - The gap between women and men is starting to shrink; women are the slight majority of stone patients in between ages 18-44
  - Every 5 point increase in BMI increases stone risk by 21%

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Stones love to come back!

20-40% symptomatic episode recurrence within 5 years

Up to 80% (symptom or radiologic) recurrence if no measures taken within 3 years

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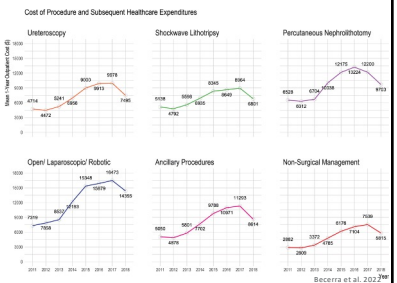
Epidemiology

- Kidney stones are a massive financial burden
- Overall costs may exceed **$4-5 billion per year in the U.S.**
  - Direct costs include clinic visits, procedures, and medications
  - Indirect costs include the impact of a primarily working age patient population



Becerra et al. 2022[19]

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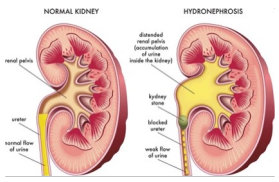
Diagnosis

What does it feel like?

- Most patients are going to present with pain
- **Obstruction of the urinary tract** is the key
  - Severe, spasming pain
  - Nausea/vomiting
  - Position and activity (generally) do not matter
- Mimics should be ruled out
  - Musculoskeletal
  - Gastrointestinal
  - Gynecological



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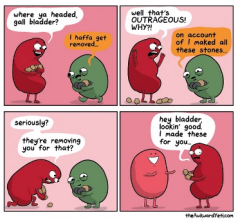
Diagnosis

- Some patients will find their stones incidentally
- **Imaging is the cornerstone** of stone diagnosis
  - CVAT is generally present
  - UA crystals are not definitive
  - Hematuria is not always present
- Other tests are adjunctive
  - Urine culture
  - Basic metabolic panel
    - Creatinine
    - Serum calcium



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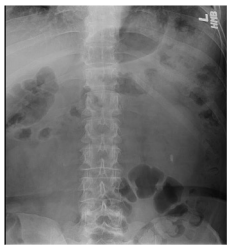
Diagnosis

Abdominal X-Ray/KUB



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Diagnosis

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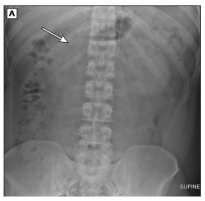

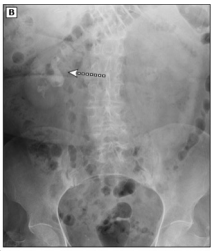

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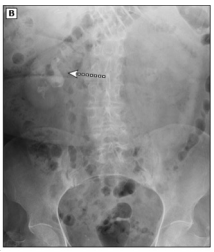
Diagnosis
Abdominal X-Ray/KUB

- KUB is best when stones are radiopaque
- Convenience
  - Easily scheduled
  - Cheap(er)
- But
  - Smaller stones are more easily missed
  - Soft stones are likely missed



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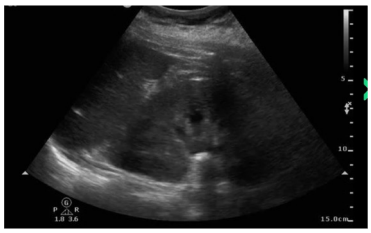
Diagnosis
Ultrasound



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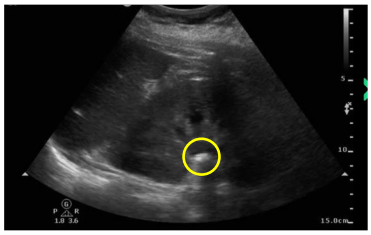
Diagnosis
Ultrasound



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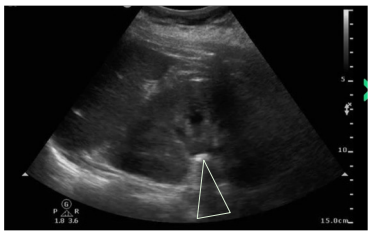
Diagnosis
Ultrasound



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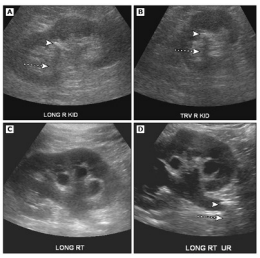
Diagnosis
Ultrasound

- Renal ultrasound has no radiation exposure
- Convenience
  - Easily scheduled
  - Cheap(er)
- But
  - Ultrasound is very operator/technician dependent
  - Smaller stones are more easily missed
  - Ureteral stones are more easily missed



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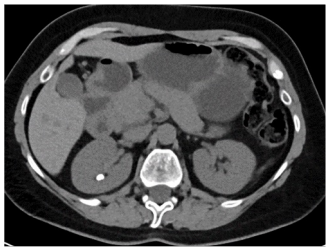
Diagnosis
CT is the gold standard - bright like bone



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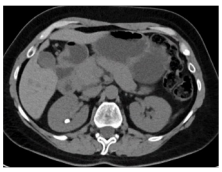
Diagnosis

CT is the gold standard - bright like bone

- Key findings on CT include:
  - Size, but remember stones are 3-D
  - Hardness, Hounsfield Units (measure of brightness)
    - Type of stone
    - Possible treatments
  - Anatomy
  - Lower radiation dose/stone-protocol CTs are available



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Diagnosis - Radiation Exposure

Imaging Modality	Effective Dose (mSv)	Details
KUB X-ray (single image)	0.22-0.63	Traditional single-image estimate
KUB X-ray (contemporary multi-image)	~2.15	92.6% of KUB examinations contain multiple radiographs rather than single image; nearly 1 in 5 patients receive doses similar to low-dose CT
Non-contrast CT stone protocol	3.0-3.3	Reference standard for urolithiasis evaluation
Low-dose CT (<3 mSv)	<3.0	Achievable with optimized protocols; pooled sensitivity 97%, specificity 95%
Standard abdomen-pelvis CT	8.2-9.3	Non-stone-specific protocols deliver substantially higher doses
CT urography (traditional multiphase)	9.7-14.8	Wide variation based on protocol

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Medical Treatment

The wait and see approach

Pain management

- NSAIDs are more effective than opiates

Medical expulsive therapy (MET)

- Alpha-blockers such as tamsulosin are the mainstay
- Evidence is mixed
- Subgroup analysis shows possible benefit:
  - Ureteral stones > 5mm
  - Distal ureteral stones

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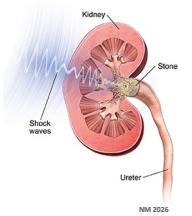
Surgical Treatment

What to tell patients what to expect

Lithotripsy is the breaking of stones

- Extracorporeal shockwave lithotripsy (ESWL)
  - Pros
    - Non-invasive
    - No energy, less injury risk to urinary tract
  - Cons
    - Requires stones to be visible on X-ray
    - Lower stone passage rates
    - No stone for analysis
- "Getting slapped in the back 3000 times"
  - Contraindications include anticoagulation use, morbid obesity, pregnancy



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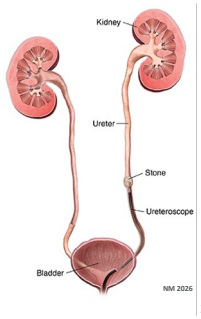
Surgical Treatment

What to tell patients what to expect

Lithotripsy is the breaking of stones

- Ureteroscopy
  - Pros
    - Minimally invasive
    - Higher success rate
    - Immediate stone removal and analysis
  - Cons
    - Risk of thermal/pressure/direct injury to urinary tract
    - Possible ureteral stent placement



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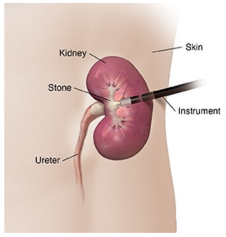
Surgical Treatment

What to tell patients what to expect

Lithotripsy is the breaking of stones

- Percutaneous nephrolithotomy (PCNL)
  - Pros
    - Best, efficient for large volume stones
  - Cons
    - More invasive
    - Higher risk of bleeding
    - Higher risk of infection
- New ureteroscopy technologies can take over some former PCNL cases



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Surgical Treatment
The dreaded ureteral stent

Setting expectations

- Typically placed to allow for better post procedural healing and prevent obstruction
- Most patients will tolerate the stent well
- **"May feel like a UTI"**
  - Urinary urgency/frequency
  - Gross hematuria
  - Dysuria
  - Flank pain/aching

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Surgical Treatment
The dreaded ureteral stent

Stent discomfort management

- NSAIDs
- Flomax
- Pyridium
- Muscle relaxants

Stent removal

- String
- Office cystoscopy

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Surgical Treatment
When does something need to be done soon?

Red flags for triage

- **Obstructing stone + infection** means an emergency
  - Fevers/chills
  - Lightheadedness/dizziness, orthostatic
  - New dysuria
- Intractable vomiting, cannot keep anything down
- Intractable pain, uncontrolled pain, multiple ER visits

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Surgical Treatment

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Requires ureteral stent placement emergently

- Mortality from obstructed, infected urinary tract **can approach 20%**
- Percutaneous nephrostomy tube placement if unable to place stent

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Surgical Treatment

When does something need to be done soon?

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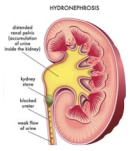
Requires ureteral stent placement emergently

Cannot treat a kidney stone with active infection



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- Consider similar warning signs post intervention

Febrile UTI ~9-14% after stone intervention

- Not always sepsis
- Fevers can be post surgery inflammation

Alarm signs postoperatively

- Hypotension (dizziness, lightheadedness)
- Rigors
- Persistent fevers

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Follow-up

What happens after stone treatment?

Stones love to come back!

20-40% symptomatic episode recurrence within 5 years

Up to 80% (symptom or radiologic) recurrence if no measures taken within 3 years

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Follow-up

What happens after stone treatment?

Goal is to lower the risk of recurrence

- General tips include
  - Dietary modifications
    - Increase fluids
    - Lower salt
    - *Do not avoid calcium*
    - Lower animal protein
  - Work on medical comorbidities
    - Metabolic syndrome
    - Hyperparathyroidism
    - GI conditions
    - Osteoporosis

Stones love to come back!

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Up to 80% (symptom or radiologic) recurrence if no measures taken within 3 years

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Prevention

The 24 hour urine collection

- Patient instructions (may vary by lab)
  - Time sensitive
  - Add preservative first
  - Do not refrigerate
  - Do not take vitamin C
- Considerations
  - Weekday and weekend collections
  - Repeat in 6-12 months

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Prevention
Ins/Outs

24 Hour Urine Collection Goals
- Urine production
- Urinary citrate - stone inhibitor
- Urinary calcium
- Urinary pH
- Urinary oxalate
- Urinary sodium
- Urinary uric acid

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Prevention
Ins/Outs

24 Hour Urine Collection Goals

• Urine production	➢ **Aim for >2L of urine output a day**
• Urinary citrate - stone inhibitor	➢ Potassium citrate, 20meq BID **or** 2-3 oz lemon juice BID
• Urinary calcium	➢ Maintain 1000 to 1200mg of calcium intake daily
• Urinary pH	➢ Potassium citrate **or** ¼ teaspoon of baking soda BID
• Urinary oxalate	➢ Limit oxalate rich foods (sort of)
• Urinary sodium	➢ Limit dietary sodium to 1500 to 2300mg daily
• Urinary uric acid	➢ Lower animal protein

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Ins/Outs

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Ins/Outs

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• Urinary uric acid	➢ **Lower animal protein**

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Prevention
What medications can help

Thiazide diuretics
- Chlorthalidone
  - Indapamide
  - Hydrochlorothiazide is less preferred
- Check basic metabolic panel, may need potassium supplementation

Potassium citrate
- Addresses both urinary pH and citrate
- Care with GI upset and renal function

Supplements
- Litholyte
- Moonstone
- Crystal Light
- Lemon juice

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Prevention

What medications can hurt

Thiazide diuretics

- Chlorthalidone
  - Indapamide
  - Hydrochlorothiazide is less preferred
- Check basic metabolic panel, may need potassium supplementation

Potassium citrate

- Addresses both urinary pH and citrate
- Care with GI upset and renal function

Supplements

- Litholyte
- Moonstone
- Crystal Light
- Lemon juice

Supplements/Meds to avoid

- Keto, carnivore diets
- Excess vitamin D/Calcium supplementation (too much Tums)
- Vitamin C
- Topiramate
- Antiretrovirals

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Takeaways for clinical stone management

Stone management is a team sport

We will encounter more and more stones!

- Know when stones need emergent intervention
- Multiple effective treatment options exist
  - Set appropriate expectations
- Long term follow up is necessary
  - 24 hour urine collections help
  - Provide general fluid and diet tips

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