Kidney Stones or Aortic Woes: Evaluation and Management of Patients with Flank Pain

Flavia Nobay, MD
Assist Clinical Prof. of EM
UCSF Medical Center
Objectives

- Discuss the numerous etiologies of non-traumatic, non-obstetrical flank pain in the adult
- Discuss the current evaluation and management of the patient with renal colic
- Identify life-threatening causes of flank pain
- Describe strategies to avoid the misdiagnose of flank pain
DDX OF FLANK PAIN

- UROLOGICAL
- INTRA-ABD
- MASS
- VASCULAR
- MUSCULOSKELETAL
- GYN/OBSTETRICAL
- TRAUMA
Urological Ddx of Flank Pain

- Nephrolithiasis
- Pylonephritis
- Renal/adrenal mass
- Renal Hemorrhage
- Papillary Necrosis
- Urethral tumors
- strictures
- Urinary Retention
- Glomerulonephritis
Nephrolithiasis - Epidemiology

- 10% of men & 3% of women
- 70% between 20 and 50 yo
- Regional variation exists
- Characteristics of people with stones
Nephrolithiasis - Risk Factors

- Primary risk factor is a previous stone
  - Recurrence in 1 year - 15%
  - Recurrence in 5 yrs - 35%
  - Recurrence in 10 yrs - 50%
    - M > F
- Family hx of kidney stones
  - 2.5 X more likely
Nephrolithiasis - Types of Stones

- Calcium - 80% OF STONES
  - IDIOPATHIC
  - Dehydration
  - Dietary characteristics
    - Oxalate rich diet - (spinach, chocolate, peanuts)
    - Excessive calcium
    - Apple, grapefruit and tomato juices, strong teas
  - Systemic illness
Nephrolithiasis - Types of Stones

- Uric Acid Stones
  - 10% of stones
  - Gout
Nephrolithiasis - Types of Stones

- Struvite Stones ("UTI stones")
  - Often asx
  - Risk group
    - Female
    - Alkaline pH
    - UTI
  - Staghorn
Staghorn Calculi
Nephrolithiasis - Types of Stones

- Cysteine stones
  - Rare ( <1% of stones)
  - Systemic Illness of cystinuria
Nephrolithiasis - History

- Clinical Triad - 90% probability of having a stone!
  - Unilateral costo-vertebral angle pain
  - Abrupt onset of pain
  - Hematuria
Nephrolithiasis - Other Symptoms

- Radiation of pain - up to 70%
- Nausea
- Vomiting
- Dysuria
- Urgency
Nephrolithiasis - Pain

- Acute unilateral costo-vertebral angle pain
  - Timing - early am and late pm
  - Not affected by body movement
  - Variable pain described
- Site
  - Upper tract → CVA pain
  - Lower tract → ipsilateral genital pain
Nephrolithiasis - Hematuria

- Single most discriminate predictor
- 70-88% of all patients with stones
- Absence of hematuria does **NOT** exclude Dx
  - 10-30% of documented sx stones are neg for hematuria
  - Hematuria \(\downarrow\) as you get further along from the initial onset of pain
Nephrolithiasis - Physical Exam

- Gen: uncomfortable, writhing
- VS: ↑ BP and pulse, temperature
- Skin: pale and clammy
- Abd:
  - BEWARE CVAT
  - ileus
  - No bruits
  - NI pulses distally
Nephrolithiasis - Clinical Picture

- Lab - urinalysis
  - Hematuria
  - Leukocytes and nitrites
    - <10 WBC per hpf
    - No bacteria should be seen
- Lab - BUN/Cr
  - New stone
  - Stone > 5mm
  - Pt’s with a broad ddx
  - Complicated patients
Anatomy of a Kidney

- Renal cortex
- Renal pyramids
- Renal pelvis
- Collecting ducts
- Ureter
Nephrolithiasis - Imaging Studies

- Should be performed on:
  - Patients with no prior hx of stones
  - Unclear diagnosis
  - Febrile and a stone is suspected
  - Underlying renal disorder
Nephrolithiasis - CT

- Non con CT = gold standard
  - 95% sensitive
  - 98% specific
  - 97% accurate
  - *Indinivir*
  - No data on kidney fxn
Nephrolithiasis - CT

- Excellent at diagnosing:
  - Hydronephrosis
  - Hydroureter
  - Perinephric stranding
  - Renal stones
Nephrolithiasis - CT

- Improved flow
- Charges may be higher but costs are roughly = to IVP
- Improved patient satisfaction
- Total acceptance by urology
Nephrolithiasis - CT

- Current protocols:
  - 3-5 mm
  - No po/iv contrast
  - 15 secs
Nephrolithiasis - CT Findings

- Dilated ureter
- Enlarged kidney
- Dilated collecting system
- Perinephric stranding
Nephrolithiasis - CT Findings

- Subtle perinephric stranding
Nephrolithiasis

- Collecting system dilation
Nephrolithiasis - CT Findings

- Identification of the UVJ
Nephrolithiasis - CT Findings

- UVJ anterior to the plebolith

Phlebolith
Nephrolithiasis - CT Findings

- Soft tissue sign of a renal stone
Nephrolithiasis

- Axial image of a phlebolith vs. renal stone

Soft tissue ring sign

Phlebolith
Nephrolithiasis - CT Findings

- Hydronephrosis
- Perinephric stranding
- Dilation of the R ureter
Nephrolithiasis - IVP

- IVP to enhance the filling defects
  - Filling defect
What if There Is No Stone?

- Calculus may not be visualized
  - Stone may be btwn cuts
- Volume signal averaging
- Recently passed
- Indinivir stone
Can you diagnose a stone without a stone on CT?

- Secondary signs of renal stones will allow for a diagnosis
  - Perinephric stranding
  - Hydronephrosis
  - Hydro-ureter
  - Nephromegaly
Nephrolithiasis - US

- Good for diagnosing:
  - Hydronephrosis
  - Proximal stones > 5mm
  - Intracalyceal stones
  - Distal stones at the UVJ
- No radiation exposure
- Inexpensive
Hydronephrosis - US

QuickTime™ and a Sorenson Video decompressor are needed to see this picture.
Nephrolithiasis

- Hydronephrosis
Nephrolithiasis - US

- Inadequate imaging of:
  - Renal collecting system
  - Ureter
  - Functionality
- May miss non-dilated obx uropathy from stones
- Difficult to locate intra-renal position of stone
- Limited information about other structures
- Operator dependent
Utility of US in Kidney Stones

- W/ the triad, is hydro enough to clinically diagnose a stone in a patient w/o a hx of stones?
  - unknown

- In a known stone, will an US help you?
  - Yes, (e.g) worsening obstruction will change f/u
Nephrolithiasis - US

- Bottom line: We are not there.... yet
  - ROLE UNCLEAR
  - promising modality, but not clearly superior
  - Need larger studies
  - Need a protocol to follow
Nephrolithiasis - Imaging Rec.

- CT is test of choice for stones
  - Information
  - Speed
  - Cost
  - Future therapy
- Unstable patients - US first
- Individual factors may be influential
  - Pregnancy, +/- cholecystitis, gyn process
Nephrolithiasis - Returning Pt’s

- What is the recommendation for Pts who return with stone pain?
  - Age
    - 20-50 yo with triad
    - > 60 yo consider CT scan
  - Time Course
    - <1 week
    - < 3 mo
    - 3 -12 mo
    - >12 mo
Nephrolithiasis - Acute Mgmt

- Pain medication and MODERATE hydration until the stone passes
  - Critical factor is size and degree of obstruction
- Massive hydration rationale
  - Dehydration
  - Dilution of IVP dye
Nephrolithiasis and Pain Mgmt

- **Pain control**
  - NSAIDs are at least as effective as opiates
    - Initially work faster
      - similar outcomes at 20/30 min
    - Work on smooth muscle, capsular pressure pain and local inflammation
  - Narcotics
  - Antiemetics
Nephrolithiasis Mgmt - MET

- \(\alpha\) -1 antag
- Calcium channel blockers
- Anti-inflammatory : steroids
- Antibiotics

Current recommendations by Urology
- Flomax .4 mg po qd x 1mo
- Prednisone 5 mg po qd x 10 days
- Pain control
## SIZE AND PASSAGE

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>Average time to passage</th>
<th>95% of stones passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤2</td>
<td>8 days</td>
<td>30</td>
</tr>
<tr>
<td>2-4</td>
<td>12 days</td>
<td>31</td>
</tr>
<tr>
<td>≥ 4</td>
<td>22 days</td>
<td>40</td>
</tr>
</tbody>
</table>
ED **Immediate** Urological Consults

- Infections and stone
  - UA > 10 wbc/hpf
- Acute renal failure
- Underlying renal abnormality
- Uncontrolled pain
ED Urgent Urological Consults

- Stone $\geq 7 \text{ mm}$
  - Cut off for urological procedure
  - Obstruction
- Outpatient failure of pain meds for 2-4 wks
- Worsening of previous hydronephrosis
Nephrolithiasis - D/C Instructions

- Straining urine
- Increase fluid intake > 2L
- Follow up in 72 hrs on obstructing stones
- Follow up within 4-6 weeks in non-obx stones
So... WHAT ELSE CAN IT BE?

- 90% of patients with the classic renal colic triad will have stones.
- What about the other 10%?
- What is the cost of missing other significant diagnoses?
THE MYTH

- 9.5% of patients > 65 yo referred for imaging of renal colic were diagnosed with a AAA

## Alternative Dx in Flank Pain

N-28/233

<table>
<thead>
<tr>
<th>Inflammatory</th>
<th>Tumor/Mass</th>
<th>Urological</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Chole/ Appy</td>
<td>4 Adnexal</td>
<td>2 UPJ Obx</td>
</tr>
<tr>
<td>2 Pylonephritis</td>
<td>2 Renal mass Ovarian cyst</td>
<td>1 Urethral stric Bladd outlet obx</td>
</tr>
<tr>
<td>1 Panc/cholecystitis ML, Sp. abscess</td>
<td>1 vertebral mets/panc cyst</td>
<td></td>
</tr>
</tbody>
</table>

Nazim AA et al. BMC Urology, 2003
Alternative Diagnosis in Flank Pain

- 4 studies - 2162 patients collectively
  - 2 leaking aortic aneurysms
  - 1 aortic dissection
  - 1 renal artery aneurysm
Alternative Diagnosis in Acute Flank Pain

- .18% of patients had a vascular catastrophe
- 2.5% had adnexal masses
- 1.3% had chole…. 
- .97% had appendicitis
- .93% had renal masses
- .83% had pylonephritis
- .56% had diverticulitis
AAA - Misdiagnosis

- Misdiagnosis is common
  - Classic features are absent frequently
  - 24-42% of all cases are misdiagnosed
- When a AAA is misdiagnosed, the flank pain it presents with is most frequently and inaccurately attributed to a......
- renal stone
Frequent Misdiagnosis in AAA
AAA

- Risk Factors
  - > 65yo
  - First degree relative
  - Smoking
  - HTN
  - PVD
  - Connective tissue d/o.
    - Erlos Danlos and Marfan’s syndrome
## Clinical Features in AAA

<table>
<thead>
<tr>
<th></th>
<th>Incidental</th>
<th>Expanding</th>
<th>Ruptured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abd pain</td>
<td>15%</td>
<td>70%</td>
<td>77%</td>
</tr>
<tr>
<td>Flank Pain</td>
<td>-</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>3%</td>
<td>12%</td>
<td>25%</td>
</tr>
<tr>
<td>Syncope</td>
<td>0</td>
<td>0</td>
<td>18%</td>
</tr>
<tr>
<td>Hematemesis</td>
<td>0</td>
<td>0</td>
<td>5%</td>
</tr>
<tr>
<td>Claudication</td>
<td>45%</td>
<td>18%</td>
<td>12%</td>
</tr>
</tbody>
</table>
# Physical Exam of AAA

<table>
<thead>
<tr>
<th></th>
<th>Incidental</th>
<th>Expanding</th>
<th>Ruptured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulsatile</td>
<td>51%</td>
<td>88%</td>
<td>70%</td>
</tr>
<tr>
<td>Abd ttp</td>
<td>8%</td>
<td>52%</td>
<td>41%</td>
</tr>
<tr>
<td>Triad</td>
<td>-</td>
<td>-</td>
<td>30-40%</td>
</tr>
<tr>
<td>Bruit</td>
<td>3%</td>
<td>8%</td>
<td>0</td>
</tr>
<tr>
<td>➣ pulses</td>
<td>32%</td>
<td>18%</td>
<td>6%</td>
</tr>
<tr>
<td>Anuria</td>
<td>0</td>
<td>2%</td>
<td>0</td>
</tr>
</tbody>
</table>

AAA

- Urinalysis
  - Can be Heme+
    - Up to 87%
AAA

- CT - Pros
  - ↑ detection of rupture, viscera & vascular involvement
  - Better at imaging
    - Suprarenal aorta
    - Thrombus/hematoma
    - Dissections
    - Retro-peritoneal structures
    - AAA abdominal impact
AAA

- CT Scan - cons
  - Not an option with unstable patients
  - Significant time to obtain
  - Radiation exposure
  - More costly than US
AAA

- **US - Pros**
  - Best modality in unstable patients
  - preferred method of assessing and following a stable aneurysm
  - high sensitivity
  - Accurate within 3-4 mm
  - ↓ radiation, invasiveness and cost
AAA on US

QuickTime™ and a Sorenson Video 3 decompressor are needed to see this picture.
AAA

- **US - Cons**
  - Limited in ability to evaluate retroperitoneal rupture
    - Accounts for 90% of ruptures
  - Not ideal evaluating complications
  - Not ideal for imaging the thoracic or suprarenal aorta
AAA

- **Summary**
  - US use - screening and following growth of a stable aneurysm
  - US - Bedside eval. of the unstable patient
  - CT is *superior* to US for evaluating AAA in setting of undifferentiated flank pain
Summary Points

- Primary diagnosis in flank pain is renal stones
- Secondary diagnosis is mass/inflammatory lesion
- Vascular catastrophes are RARE
- Hematuria ≠ renal stone
Summary Points

- NCHCT = best imaging test for undifferentiated flank pain
- US - emerging modality
  - not yet standard of care
- Patient Profile - use risk factors, hx and PE to help prioritize the differential
Thank you

Questions ??????