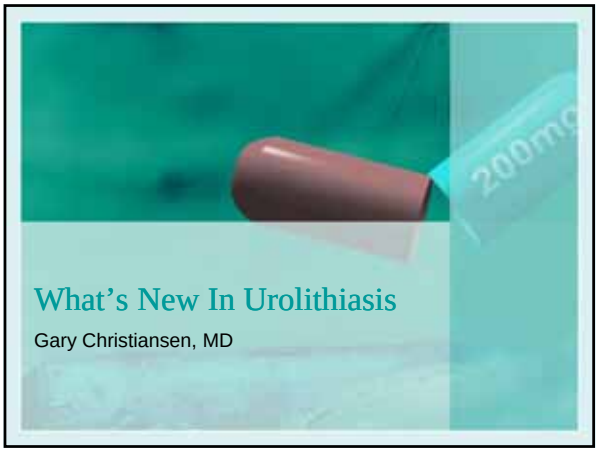


What's New In Urolithiasis

Gary Christiansen, MD

Renal and Ureteral Calculi

- Risk Factors
  - Prevalence – 2-3%
  - Estimated lifetime risk - 12%
  - Gender: male:female 1.3:1
  - Family History: 3-fold increased risk
  - Body Size: increased risk with increased weight

Renal and Ureteral Calculi

- Recurrence rate after first stone
  - Year 1 10 – 15%
  - Year 5 50 – 60%
  - Year 10 70 – 80%

Urolithiasis: Clinical Presentation

- Renal Calculi
  - Vague flank pain
  - Recurrent infections
  - Hematuria

Urolithiasis: Clinical Presentation

- Ureteral Calculi
  - Flank or abdominal pain
  - Hematuria in 85%
  - Urinary frequency and urgency with stones near the bladder

Urolithiasis: Differential Diagnosis

- Appendicitis
- Cholecystitis
- Diverticulitis
- Colitis
- Constipation
- Hernia
- Arterial aneurysm
- Other urologic problems
  - UTI
  - UPJ obstruction
  - Other ureteral obstructions
  - Renal or ureteral tumor

Urolithiasis: Differential Diagnosis

- Women
  - Ovarian tumor or cyst
  - Ovarian torsion
  - Ectopic pregnancy
- Men
  - Testicular torsion
  - Testicular tumor
  - Orchitis
  - Epididymitis

Urolithiasis: Establishing the Diagnosis

- History
- Physical exam
- Urinalysis
- Imaging
  - Ultrasound
  - Plain films
  - IVP
  - CT

Abdominal Ultrasonography

- 19% Sensitivity
- 97% Specificity if a stone is seen
- Non-invasive
- Poor visualization of ureteral stones

Plain Film – KUB

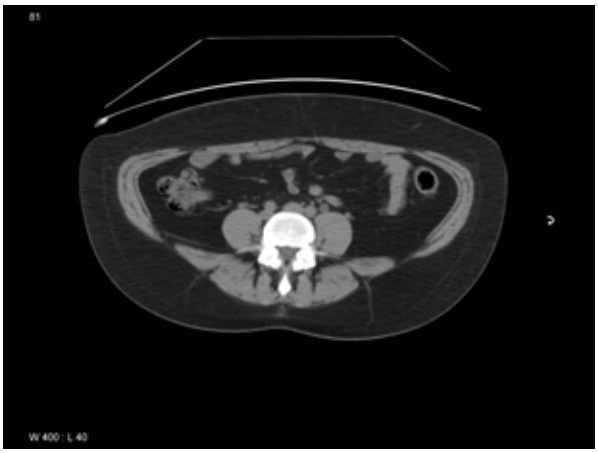
- Helpful for calcium stones
- Calculi may be difficult to see
- 50% Sensitivity
- 75% Specificity
- More useful if there is a known stone

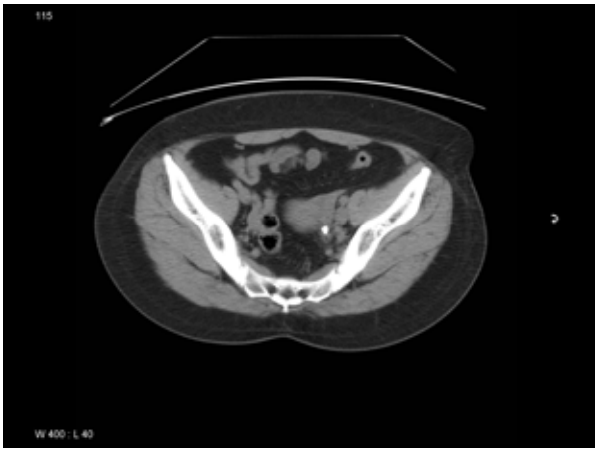
Intravenous Pyelogram (Urogram)

- Considered the gold standard for years
- Widely available
- Requires proper bowel prep
- 65 – 90% Sensitivity
- 90% Specificity
- Requires I.V. contrast

Non-Contrast CT

- Best initial means of assessment
- 95% Sensitivity
- 95% Specificity



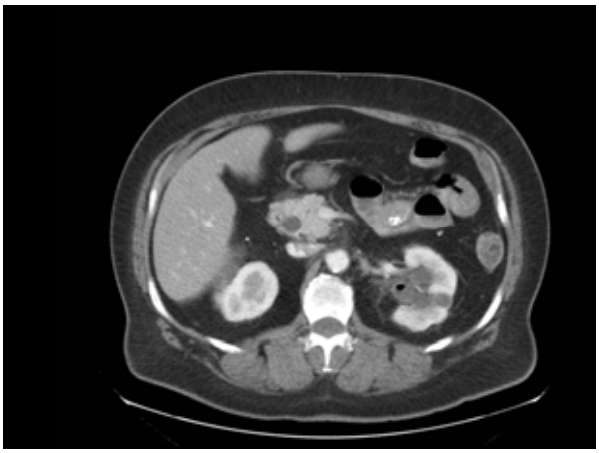


Non-Contrast CT

- More x-ray exposure than IVP
- More expensive than IVP
- May show non-urologic pathology
- For now, this is the gold standard

Management of Urolithiasis

- Emergent intervention
  - UTI with sepsis and obstruction
  - Anuria
  - Renal failure



Management of Urolithiasis

- Hospital admission if:
  - Refractory pain
  - Persistent Nausea
  - Very old or very young

Probability of Stone Passage

- Dependent on size and location
- Larger (>5 mm) are less likely to pass
- More proximal stones are less likely to pass

Probability of Stone Passage

- 70% of stones will pass spontaneously
- Put another way:
  - <4 mm 90% will pass
  - 4-8 mm 50% will pass
  - >8 mm Unlikely to pass

Medical Expulsion Therapy

- Hydration
- Beta-blockers
- Calcium – channel blockers
- Corticorteroids

Medical Expulsion Therapy

- Alpha – blockers
- High concentration of α1d receptors in ureter
- Tamsulosin, Terazosin and Doxazosin all efficacious
- Increases stone expulsion rates to 78% from 53%
- Lowers time to stone passage to 6 days from 10.5

Surgical Management

- Extracorporeal shock wave lithetripsy (ESWL)
- Percutaneous nephrolithotomy
- Ureteroscopy
- Treatment is based on stone size and location

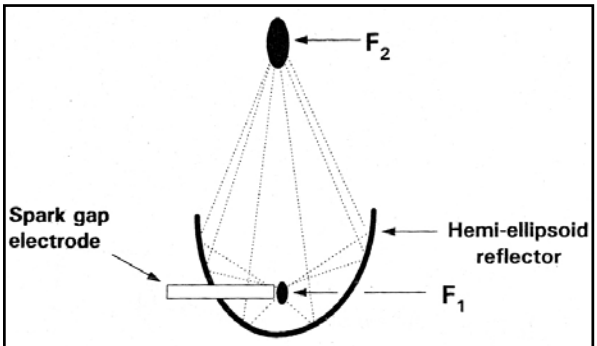


Figure 92–1. Schematic diagram of electrohydraulic (spark gap electrode) shock wave generation. Shock waves generated by a spark gap electrode are focused by a hemiellipsoid reflector at the second focal point (F_2).

Complications of ESWL

- Hematuria
- Flank pain
- Skin Bruising
- Sepsis
- Steinstrasse
- Perinephric Hematoma (<1%)
- Bowel/Pancreatic/Spleen/Liver/ Pulmonary injury (very rare)

Percutaneous Nephrolithotomy

- Indicated for larger renal calculi
- Requires percutaneous access
- Direct visualization and removal of stones

Complications of Percutaneous Nephrolithotomy

- Infection/Sepsis
- Bleeding
  - 2% require transfusion
  - May require angiography and selective arterial embolization
- Bowel injury
- Hydrothorax or pneumothorax
- AVM

Treatment of Renal Calculi

- Stone < 10mm
  - ESWL
- 10 – 20 mm
  - ESWL
  - Sometimes ureteropyeloscopy or
  - Percutaneous nephrolithotomy
- > 20 mm
  - Percutaneous nephrolithotomy

Ureteroscopy / Pyeloscopy

- Technologic advances have expanded it's role
- 6.9 French rigid scopes and 7.5 French flexible ureteroscopes now available

Ureteroscopy

- Direct stone extraction with basket
- Intracorporeal lithotripsy
  - Pneumatic
  - Electro hydraulic
  - Ultrasonic
  - Laser

Holmium : YAG Laser Lithotripsy

- Stone destruction from a thermal/vaporization process
- Minimal tissue penetration (< .5 mm)
- Can be used with rigid or flexible ureteroscope
- Very small (200 micron) fiber is available
- Excellent fragmentation of all kinds of stones

Metabolic Evaluation

- Stone analysis
- 24-hour urine collection

Calcium Stones	Uric Acid
Volume	Volume
Calcium	Uric Acid
Oxalate	pH
Phosphorus	
Citrate	
Magnesium	
Sodium	

Metabolic Evaluation: Classification Calcium Stones

- Hypercalciuria (40-75%)
- Hyperuricosuria (10-50%)
- Hyperoxaluria (<9%)
- Hypomagnesuria (<5%)
- Hypocitraturia (10-50%)

Metabolic Evaluation: Classification Non-Calcium Stones

- Low urinary pH
  - Uric acid stones (5%)
- Cysteinuria
  - Cystine stones (1%)
- Infection
  - Struvite stones (15%)

Metabolic Evaluation

- Hypercalciuria is a common finding
- Serum calcium and PTH are helpful to define the problem further

Absorptive Hypercalciuria

- Intestinal hyperabsorption of calcium
- Normal serum calcium
- PTH normal or low
- Usually treated with thiazides

Renal Hypercalciuria – "Renal Leak"

- Decreased renal resorption of calcium
- Normal serum calcium
- Elevated PTH
- Thiazides correct secondary hyperparathyroidism

Resorptive Hypercalciuria

- Primary hyperparathyroidism
- Elevated serum calcium
- Elevated PTH
- Evaluate for parathyroidectomy

Uric Acid Stones

- 24-hour urine collection for pH and uric acid
- Hyperuricosuria (>850 mg/day) – Use Allopurinol
- Low urinary pH
  - Treat with urinary alkalinization
  - Potasium citrate 40-60 mEq/day
  - Sodium bicarbonate 1.2 gm bid

Dietary Calcium in Stone Disease

- Early recommendations of low calcium diet
- 1993 study of 100,000 patients
  - Calcium intake inversely associated with stone risk
- Low calcium diet may cause hyperoxaluria

General Dietary Recommendations

- Normal calcium intake in most patients
- Moderate calcium restriction in patients with absorptive hypercalciuria
- Low dietary intake of oxalate
  - Chocolate
  - Nuts
  - Spinach
  - Tea
- Limit sodium intake
- Limit red meat intake

Role of Obesity

- Increased risk of urolithiasis
- Urinary pH decreases with increased weight
- Primarily uric acid calculi
- Urinary alkalinization with potassium citrate

Bariatric Surgery and Urolithiasis

- Increased risk likely on the basis of hyperoxaluria

Effect of Animal Protein Diet

- ↑ Urinary calcium
- ↑ Urinary sulfate
- ↑ Urinary uric acid
- ↓ pH
- ↓ Urinary Citrate

- All of these factors are associated with increased risk of recurrent stone formation