GU Interventions

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History of GU Interventions

- Percutaneous nephrostomy - **1955**
- Percutaneous stone removal - **1976**
- Ureteral stent placement – **late 70's**
- ESWL – **1982**
- Percutaneous tumor ablation – late 90's

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GU Interventions

- Percutaneous nephrostomy (PCN)
- Percutaneous nephrostolithotomy (PNL)
- Percutaneous ureteral interventions
- Percutaneous collection drainage
- Percutaneous biopsy
- Percutaneous tumor ablation

PCN - Indications

- Relief of obstruction
- Treat urinary leak/fistula
- Symptomatic stone disease
- Complex urinary tract infections
- Ureteral interventions
- Diagnostic and therapeutic endourologic interventions

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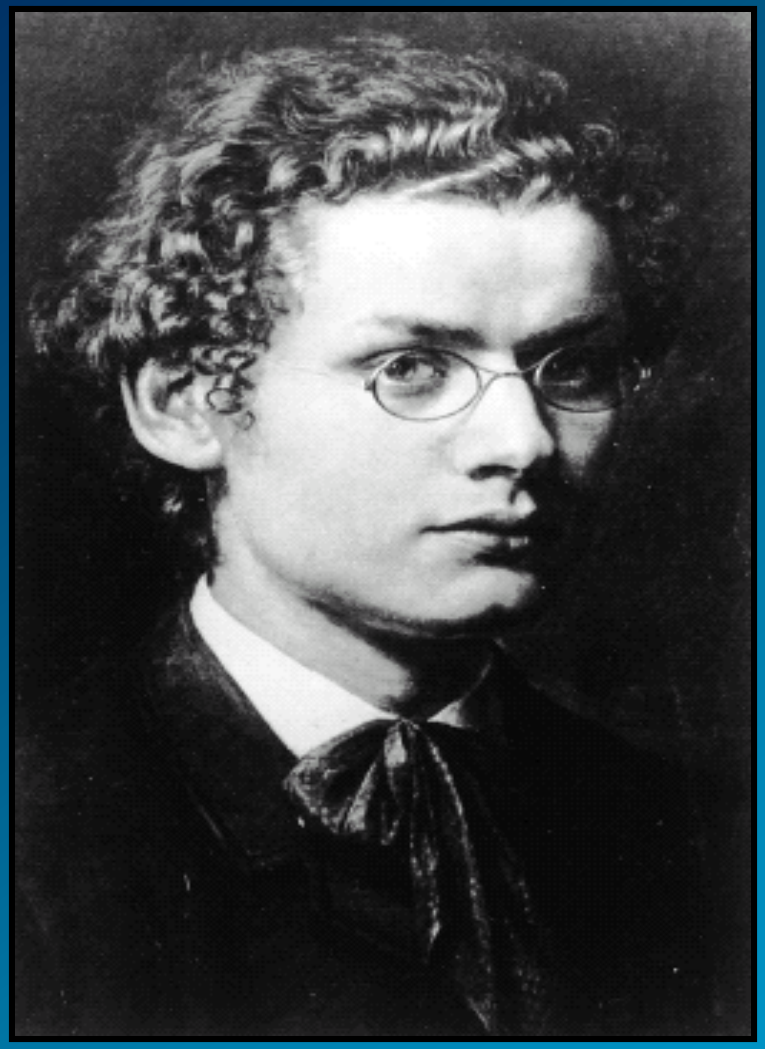
PCN – Avascular Plane



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PCN – Calyceal Entry

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PCN – Injection of Air

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PCN – Adjacent Organs

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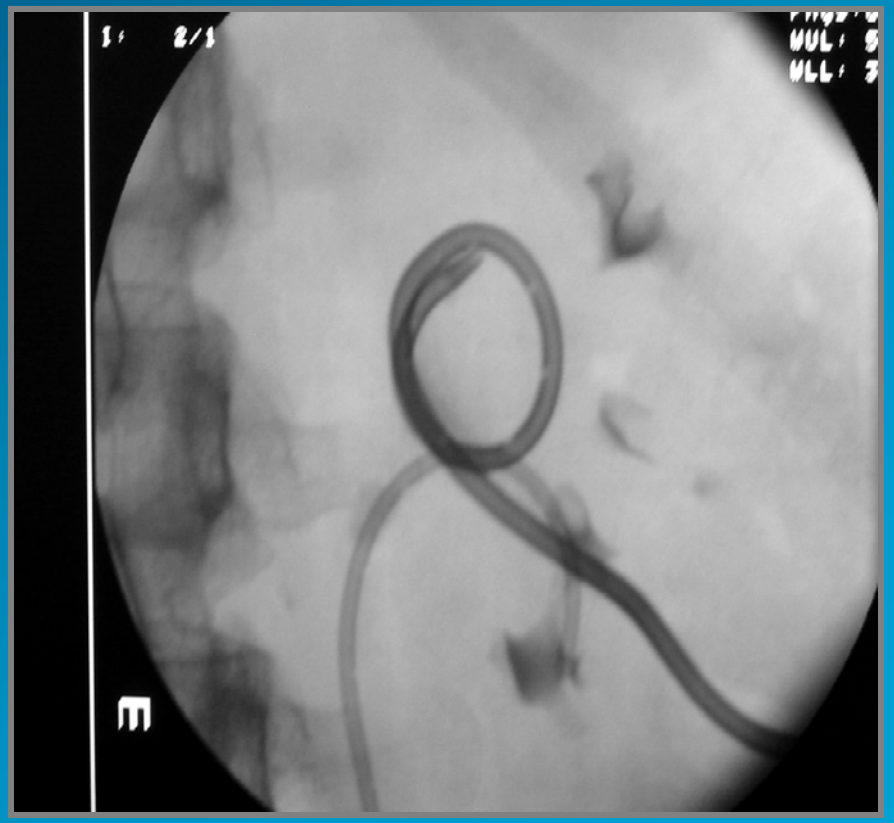
PCN – Access

- Lower calyceal group

  - best suited for simple drainage
  - usually via a posterolateral approach below the 12th rib



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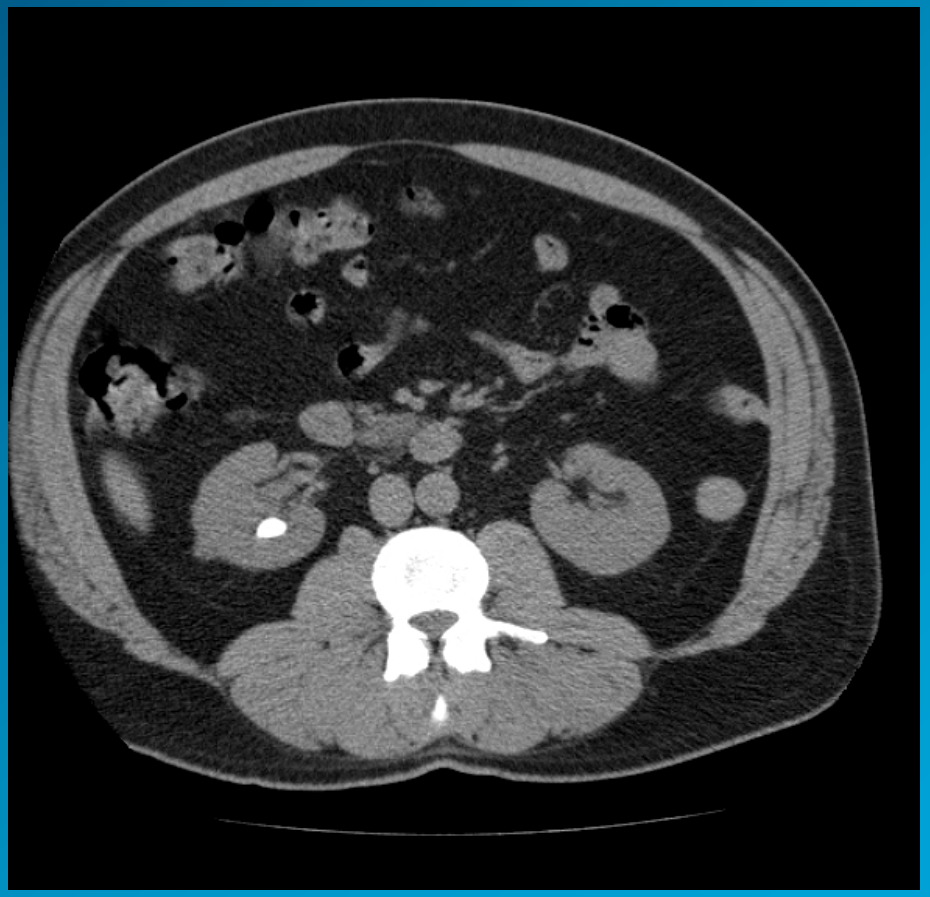
PCN – Access

- Middle calyceal group

- optimal access when ureteral manipulation is expected or targeted PCN



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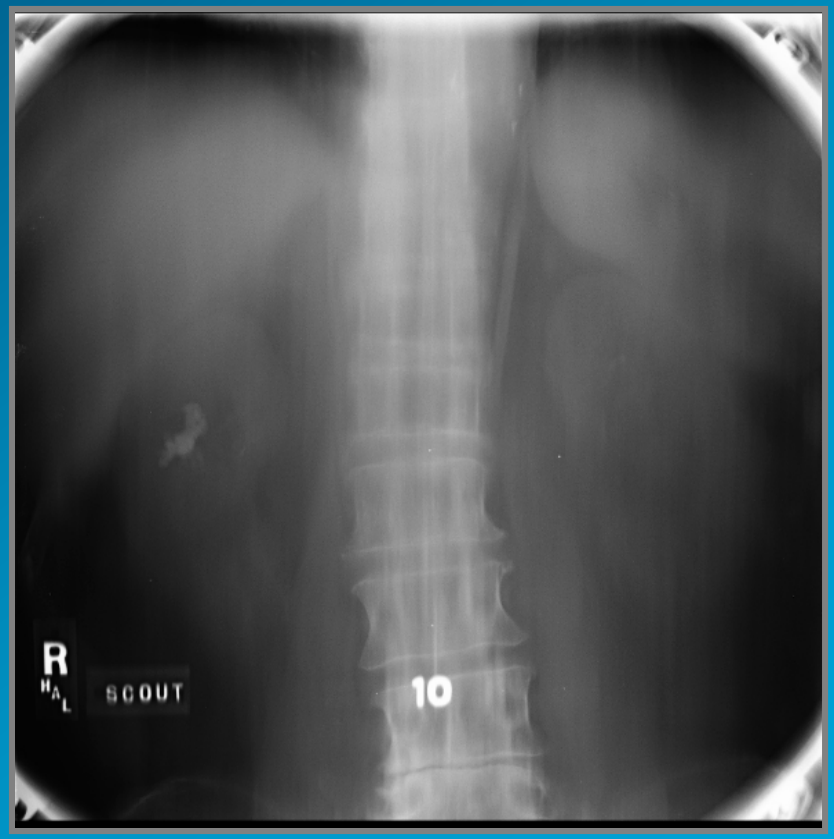
PCN – Access

- Upper calyceal group
  - usually reserved for complex manipulations (Staghorn calculus)
  - increased risk for bleeding and pleural transgression when above 11th rib



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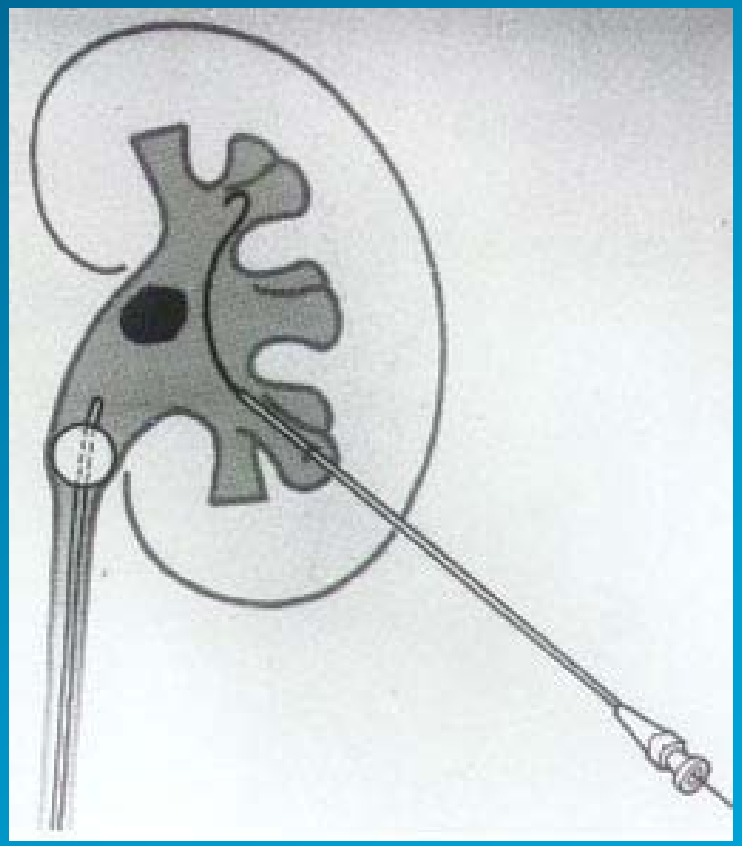
PCN - Procedure

- Prone position, IV sedation
- Guidance – ultrasound/fluoroscopy
- Access – use of 0.018-0.035 conversion system



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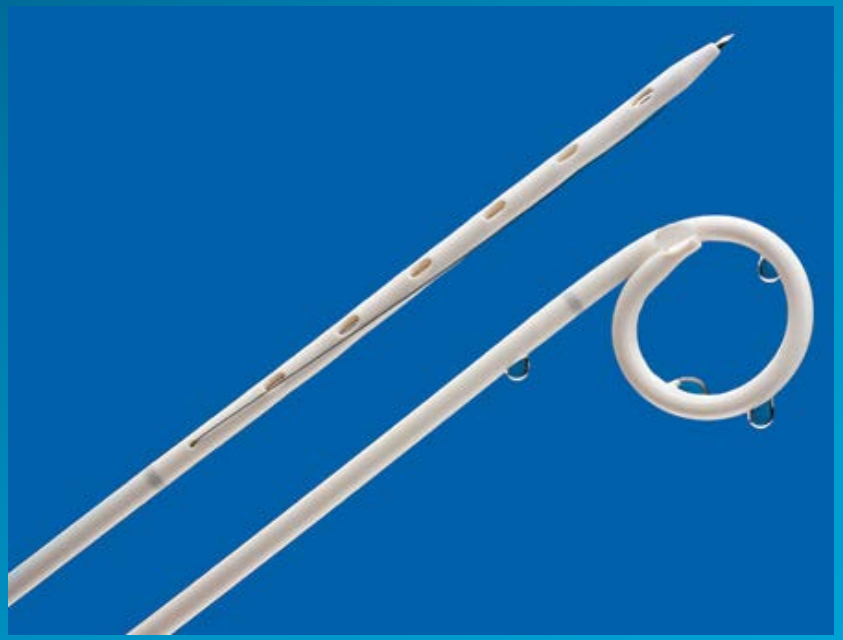
PCN - Procedure

- Sample of urine for culture
- Do not overdistend a potentially infected system
- Delivery of 8-10F Cope loop catheter



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PCN - Complications

- Hematuria

  - progressively decreases during the first 24 – 48 hrs

  - major bleeding reported in 1-2% of the cases

PCN - Complications

- Hematuria management
  - catheter upsizing
  - catheter clamping
  - tamponade balloon catheter (large tracts)
  - blood transfusions
  - renal arteriography/transcatheter embolization

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PCN - Complications

- Sepsis – 1%
- Inadvertent adjacent organ injury
- Catheter dislodgement/blockage

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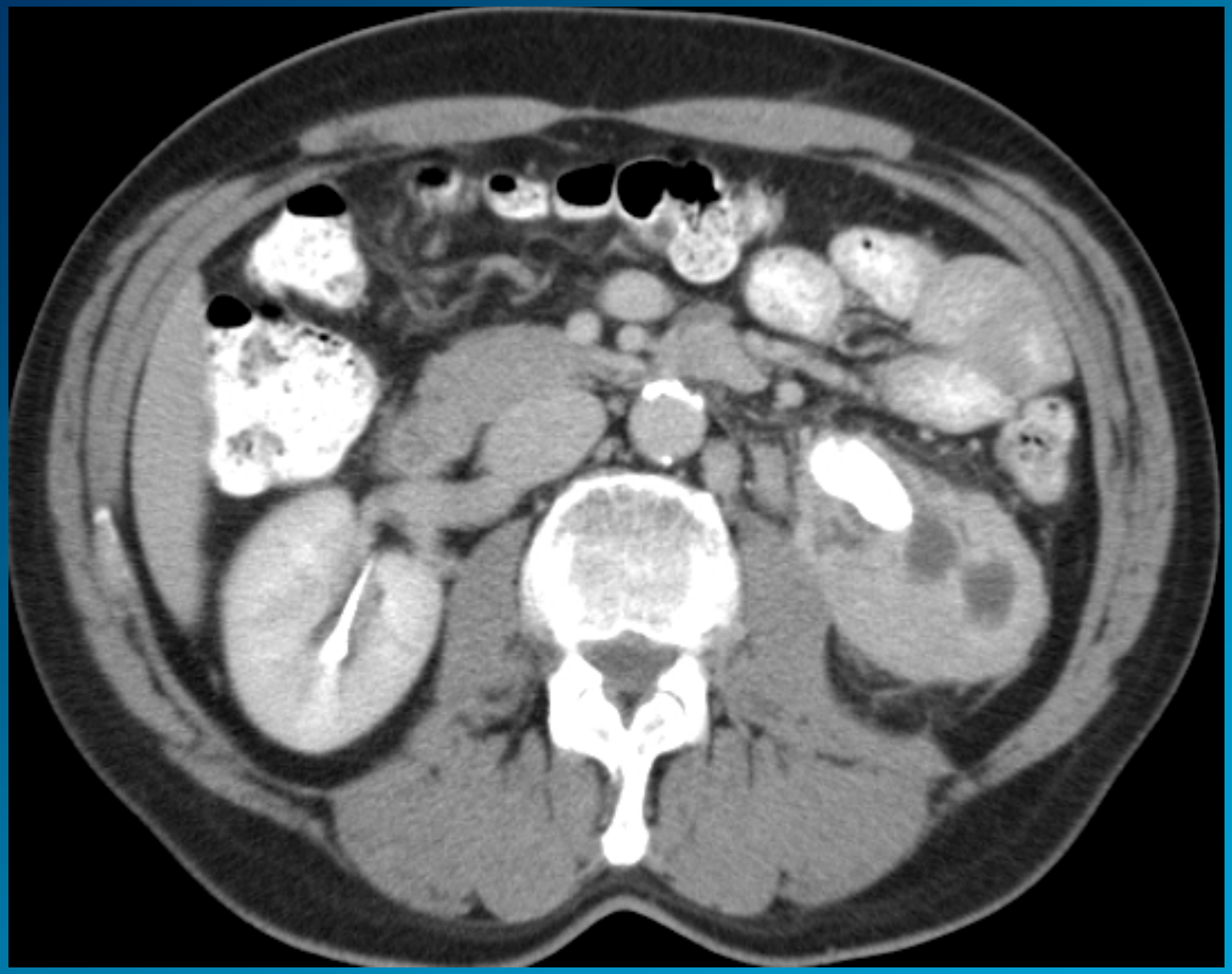

Potential Pitfall: XGP

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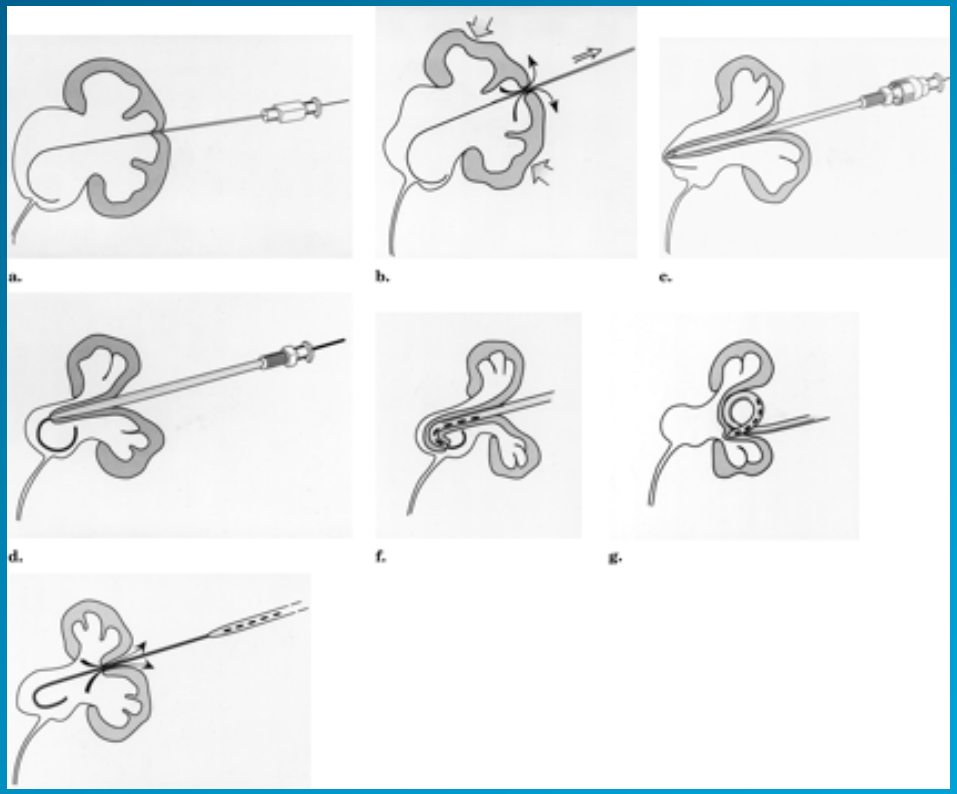
Xanthogranulomatous Pyelonephritis

- 5th -7th decade, Female > Male
- Diffuse (90%), Segmental
- Plasma cells + lipid-laden macrophages (xanthoma cells)
- Anemia (70%), elevated LFT's (25%), diabetes (10%)
- Enlarged, malfuntioning kidney with central obstructing calculus
- DDx: hydronephrosis, avascular tumor

Pediatric Nephrostomy

- Micropuncture vs. modified two-step
- Modified favored in dilated systems (UPJ)
- Micropuncuture favored for non-dilatation, distal obstruction, coagulopathy



Koral K et al. JVIR 2003; 14:113-116

Stone Therapy

- Most calculi < 8mm will pass
- Open surgical techniques are seldom used
- ESWL remains the primary modality for stones below 2 -3 cm
- ESWL limitations

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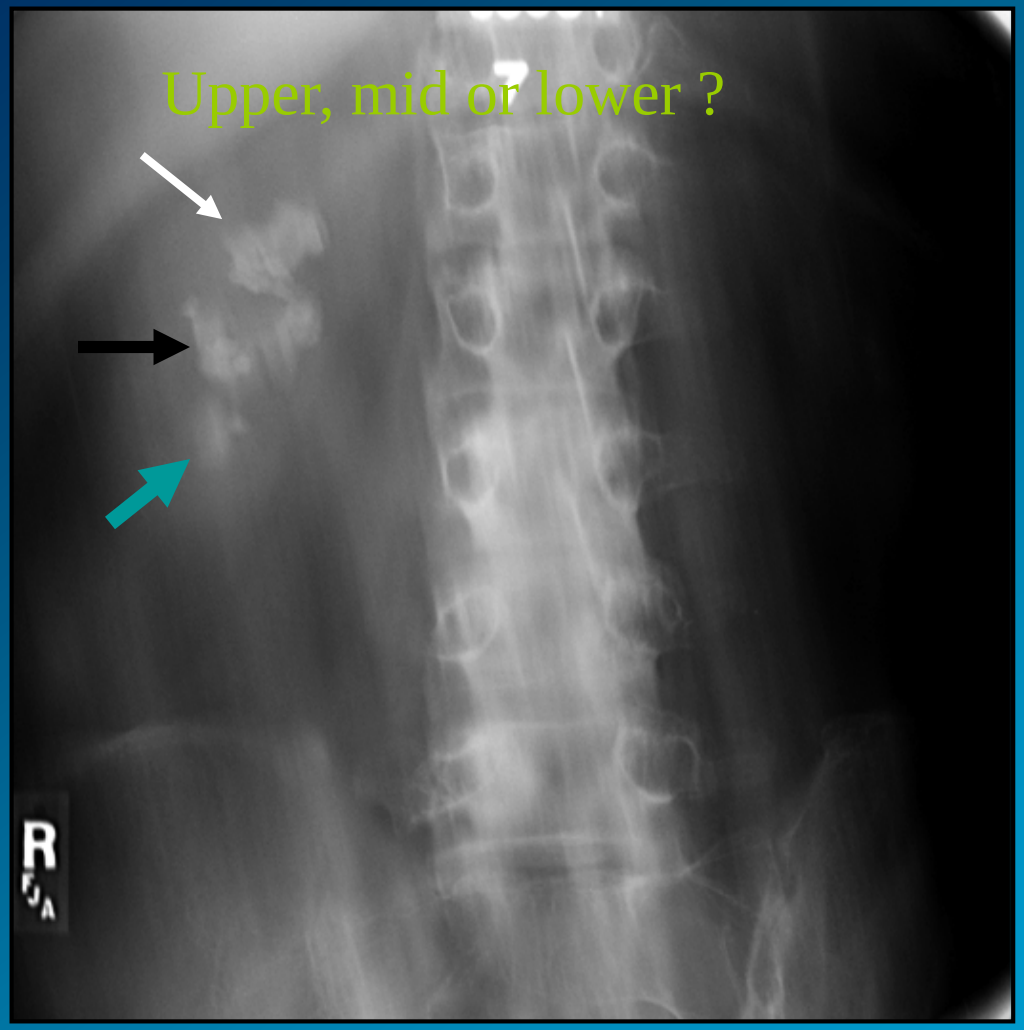
ESWL - Limitations

- Large stones > 3 cm
- Stone in lower calyx
- Impacted, large ureteral stones
- Anatomic abnormalities preventing stone passage
- Staghorn calculi – produce large fragment burden, risk for sepsis
- Pregnant or pediatric patients

PNL – Tract Selection



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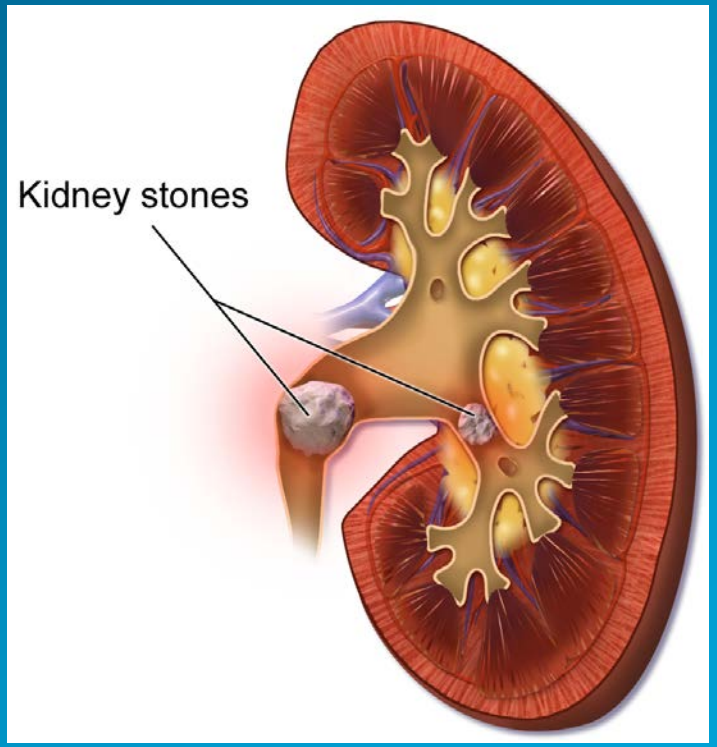
PNL - Results

- Success – 95%
- May require more than one intervention or tracts
- Complications higher than PCN, occur in 4-8%
- Most common complications include perforation of the renal pelvis and bleeding

Decompression In Stone Disease

- Obstruction, infection, renal deterioration, intractable pain
- PCN vs. DJ
- UCSD favors PCN



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PCN vs. Ureteral Stent

- Prospective, randomized, stone hydro
- 40 patients: 20 PCN, 20 DJ
- Tech success: 100% PCN, 80% DJ
- Failure of DJ in prox stone, age > 60
- PCN shorter indwelling time (p= 0.043)
- Clinical course/QOL: Tendency in favor of PCN
- No mention of complications rates

Mokhmalji H, et al. Urology 2001; 165:1088-1092

Percutaneous Renal Access

Additional Indications

- Endourologic management of upper tract TCC including biopsy
- Chemolysis for stone therapy
- Management of fungal disease
- Endopyelotomy for UPJ obstruction

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Percutaneous Ureteral Interventions

- Ureteral stent placement
- Ureteral stricture dilatation
- Ureteral occlusion

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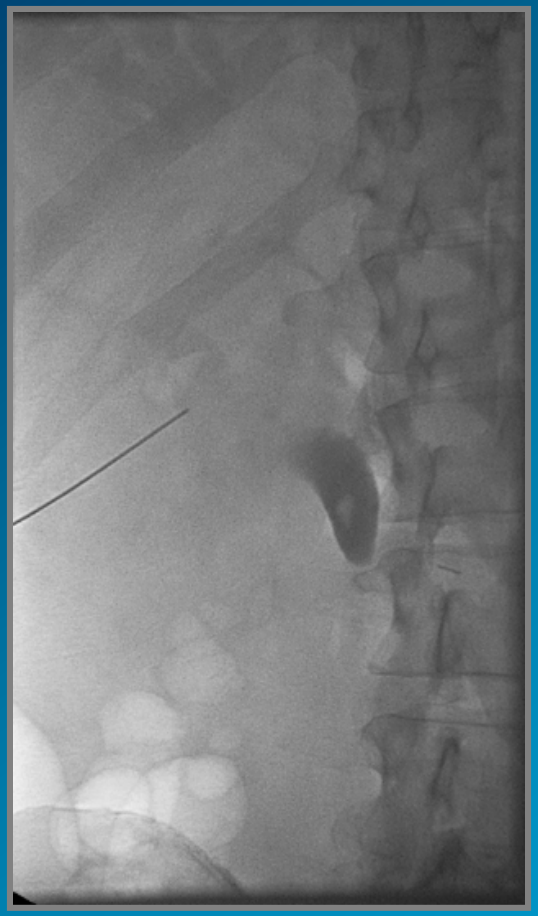
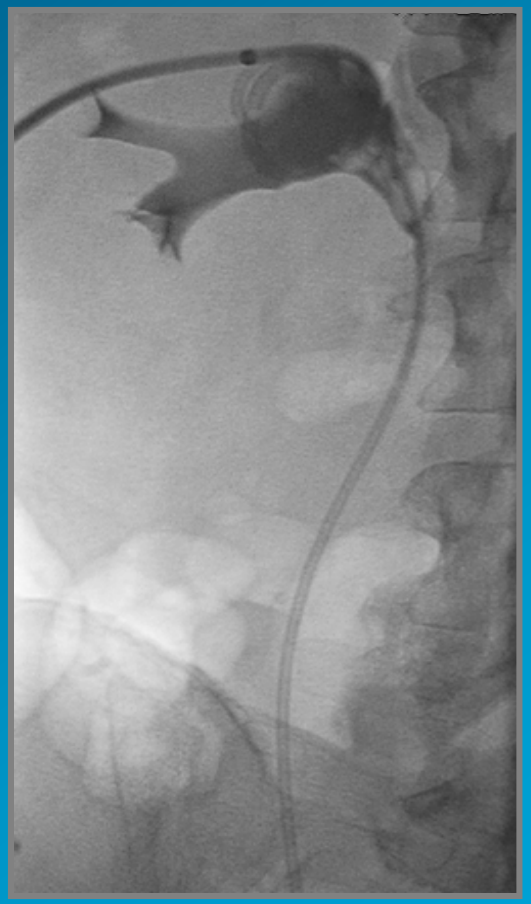
40 y/o woman with flank pain and hydronephrosis





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Ureteral Stent - Indications

- Similar to PCN – leak, obstruction, stone, fistula
- As a scaffold following balloon dilatation, endopyelotomy, or PNL
- Intra-operative ureteral identification in pelvic surgery

Ureteral Stent – Good or Bad?

- Finney and Hepperlen (1975)
- Urine flows through and around stents
- Ideal material not yet available
- Issues with infection and encrustation

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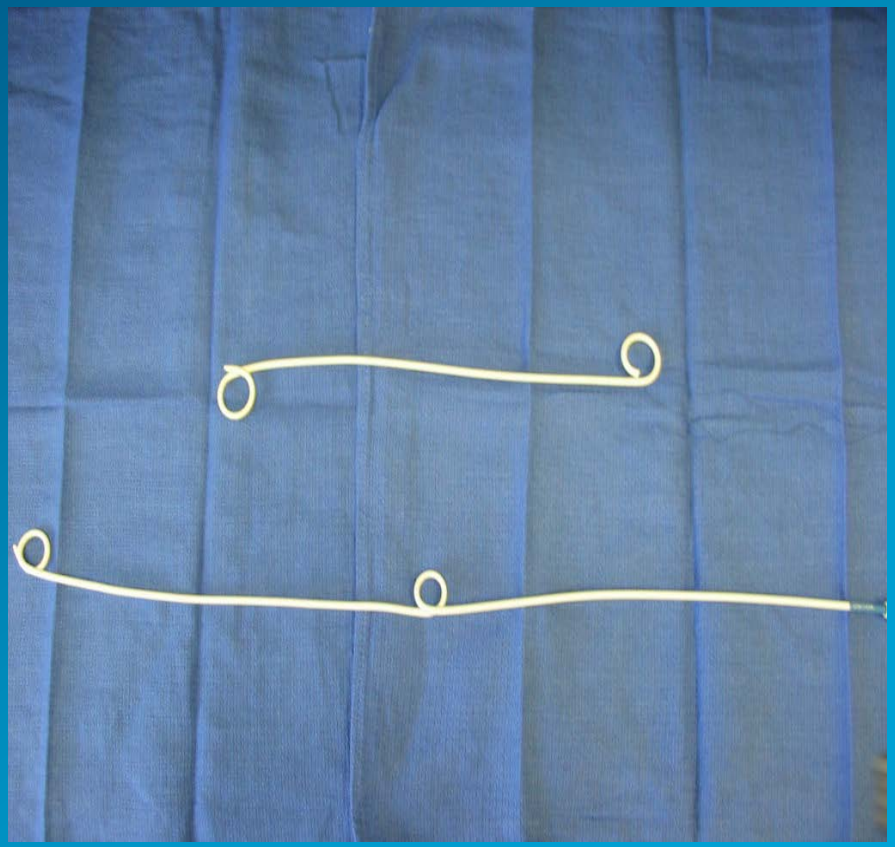
Ureteral Stent - Types

- Double pigtail stents – internal drainage
- Nephroureteral stents – both internal and external drainage



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Issues with "Double J"

- Advantages:
  - decreased rate of infection
  - better patient acceptance(maybe)

- Disadvantages:
  - difficulty in assessing for occlusion
  - require exchange every 3 – 6 months

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Ureteral Stent - QOL

- 85 consecutive patients (73%)
- 78% bothersome urinary symptoms
- > 80% with pain affecting daily activities
- 32% sexual dysfunction
- 58% reduced work capacity

Joshi HB, et al. J Urol 2003; 169:1065-1069

Ureteral Stent - Biomaterials

- Polyurethane, silicone, Silitek, C-Flex, Percuflex and metal
- PU: highly versatile and inexpensive, > urothelial ulceration and erosion
- Silicone: better tissue compatibility 2^{ry} to its nontoxic and inert nature

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Ureteral Stent - Biomaterials

- Encrustation due to rx of magnesium ammonium phosphate to urease + bacteria (**Abber JC, Kahn RI. J Urol 1983; 130: 763**)
- Coatings: Hydrogel

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Ureteral Stent – What's New?

Coatings

- Goals: facilitate delivery, reduce encrustation
- Materials:
  - Polyvinylpyrrolidone
  - Phosphorylcholine
  - Heparin
  - Oxalate degrading enzymes
  - Silver nitrate and ofloxacin

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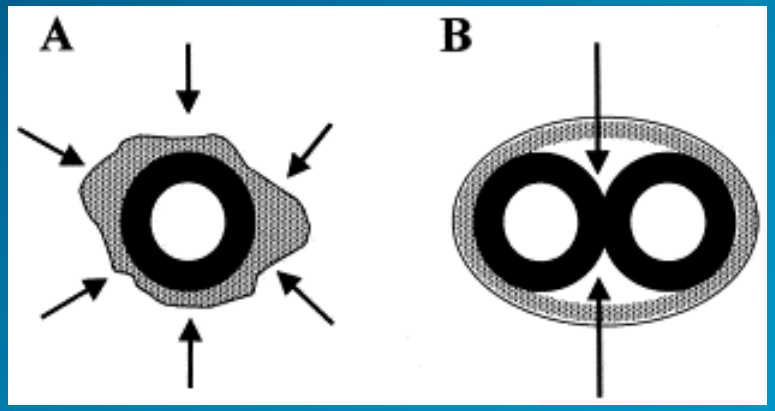
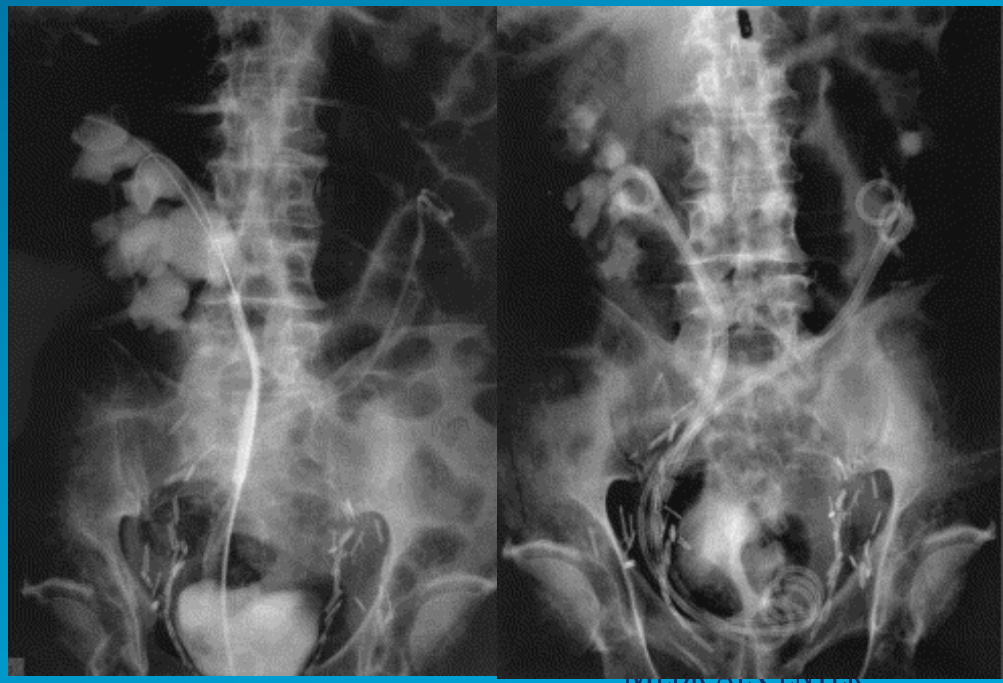
Multiple Double J's

- Failed single stent
- Extrinsic compression
- Malignancy



Liu JS, et al. J Urol 1998; 159:179-181

Fromer DI, et al. Urology 2002; 59:594-596



Ureteral Stent - Placement

- A middle calyceal approach is preferred
- 6-8F, 22-26cm
- Smaller stents for stones, larger for malignancy and following dilatation
- Careful assessment of intraluminal location both in the ureter and bladder

Ureteral Stent - Complications

- Urinary symptoms: pain, dysuria, hematuria, incontinence, bladder irritability
- Encrustation
- Infection
- Migration, fragmentation

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Ureteral Stricture Dilatation

- Balloon dilatation has modest results (50%)
- Most effective in short, recent onset and proximal strictures
- Malignant, irradiated, ischemic, inflammatory and anastomotic strictures respond less favorably

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Percutaneous Collection Drainage

- Renal and peri-renal abscess
- Urinoma
- Lymphocele

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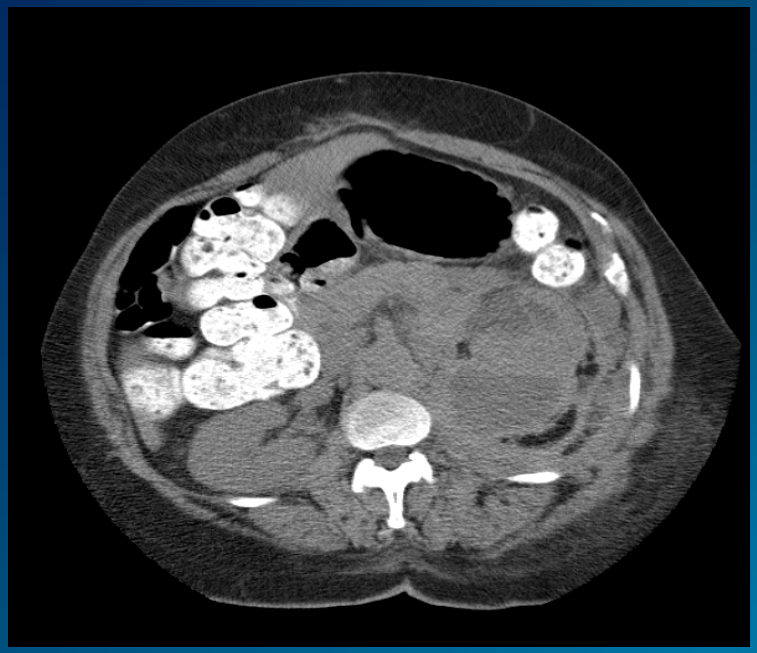

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Renal/Peri-renal Abscess

- Predisposing factors:
  - Diabetes
  - Urinary calculi
  - Obstruction
  - Debilitated
- Mortality as high as 50%
- Drain left in place until output decreases to 5-10ml in 24hrs

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3 month F/U

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Urinoma

- Etiologies:
  - iatrogenic
  - traumatic
  - obstructive
  - tumoral
  - inflammatory
  - renal tx
- Management usually includes percutaneous drainage plus PCN and ureteral stent placement

Lymphocele

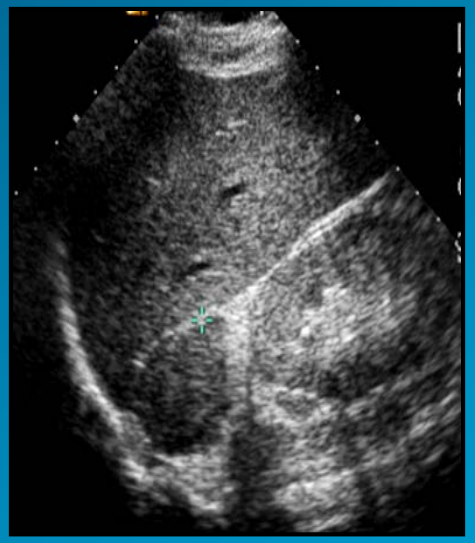
- Common as a complication following lymph node dissection and renal transplantation
- May be symptomatic when infected or by extrinsic compression to adjacent structures
- Simple drainage yields unsatisfactory results

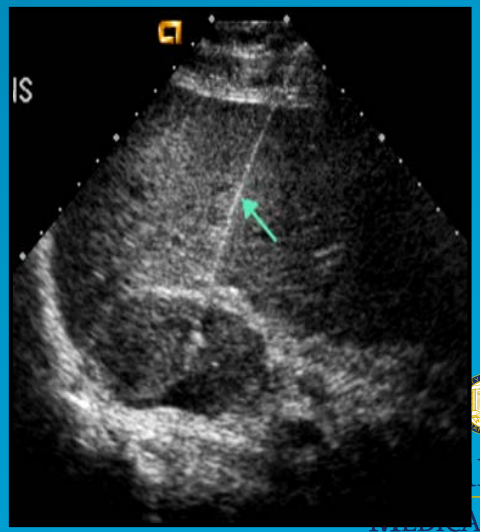
Lymphocele

- Sclerosing agents : ethanol, iodopovidone and tetracycline
- Mixed results
- Rule -out communication to bowel or urinary tract
- Half of cavity volume instilled with sclerosant with dwell time of 30-60 minutes
- Complication: 1) cavity superinfection
  2) communication injury

Percutaneous Renal/Adrenal Biopsy

- Mets, lymphoma, limited kidneys
- RCC – core for genetics, expectant management for low grade tumors, Cryo
- Transhepatic route for adrenal





Renal Tumor Ablation

- Parenchymal sparing surgery (Herring J Urol 2001)
- Small, incidentally discovered renal tumors
- Radiofrequency ablation, cryoablation, interstitial laser and high intensity ultrasound have been used
- Percutaneous or laparoscopic technique

Renal Cryo

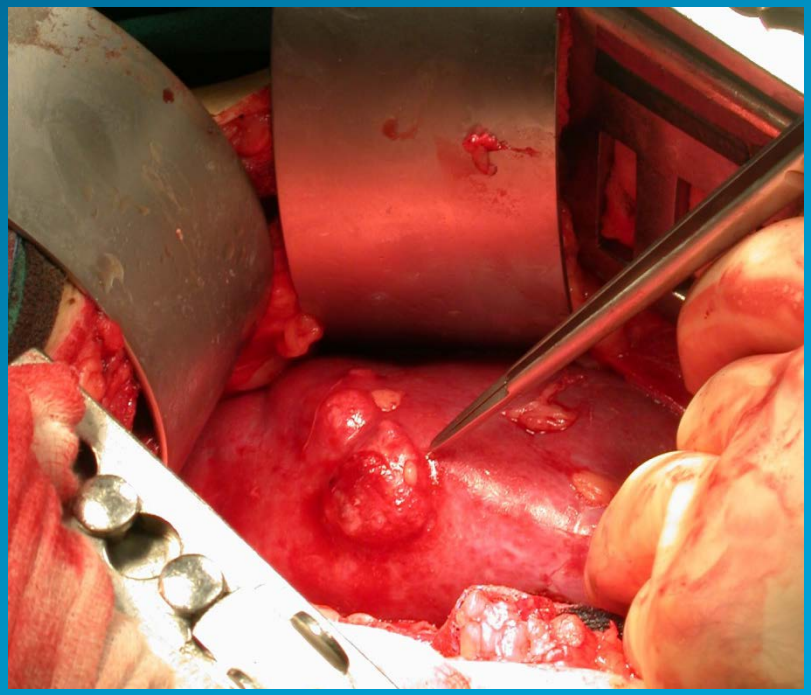
Nonsurgical candidates

- solitary kd
- mets
- multiple RCC's

Small < 3cm

Peripheral

- anterior: lap
- posterior: perc



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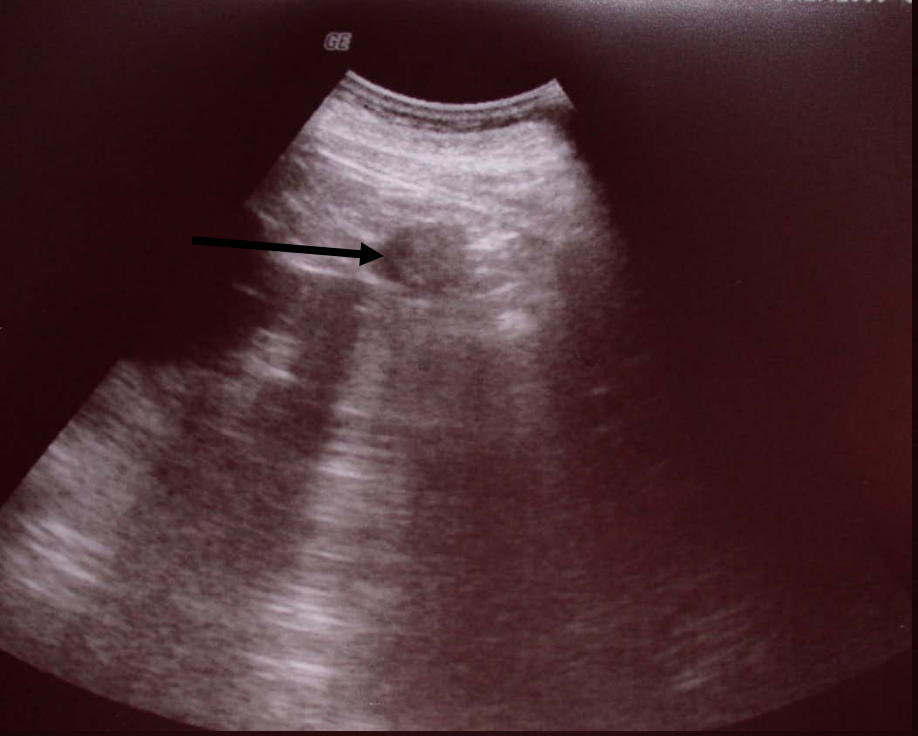
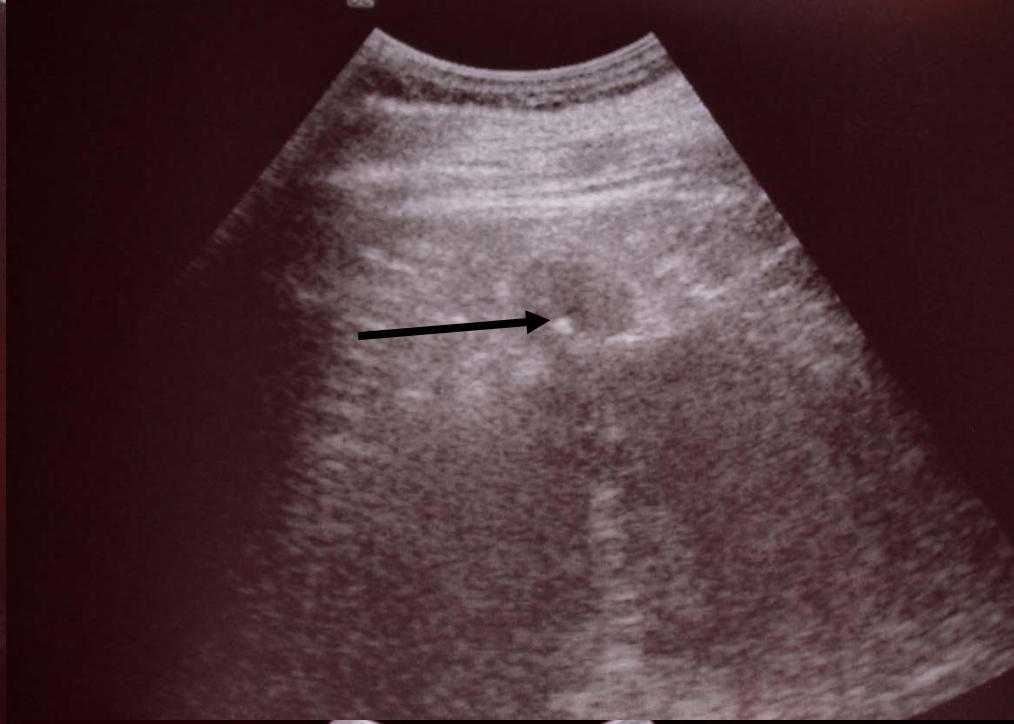
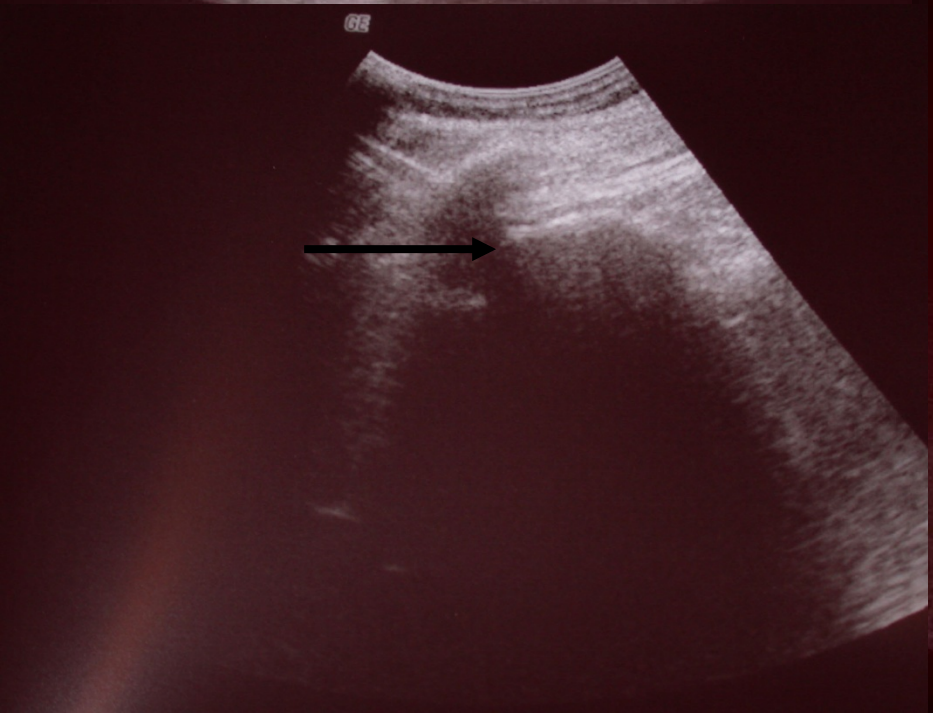
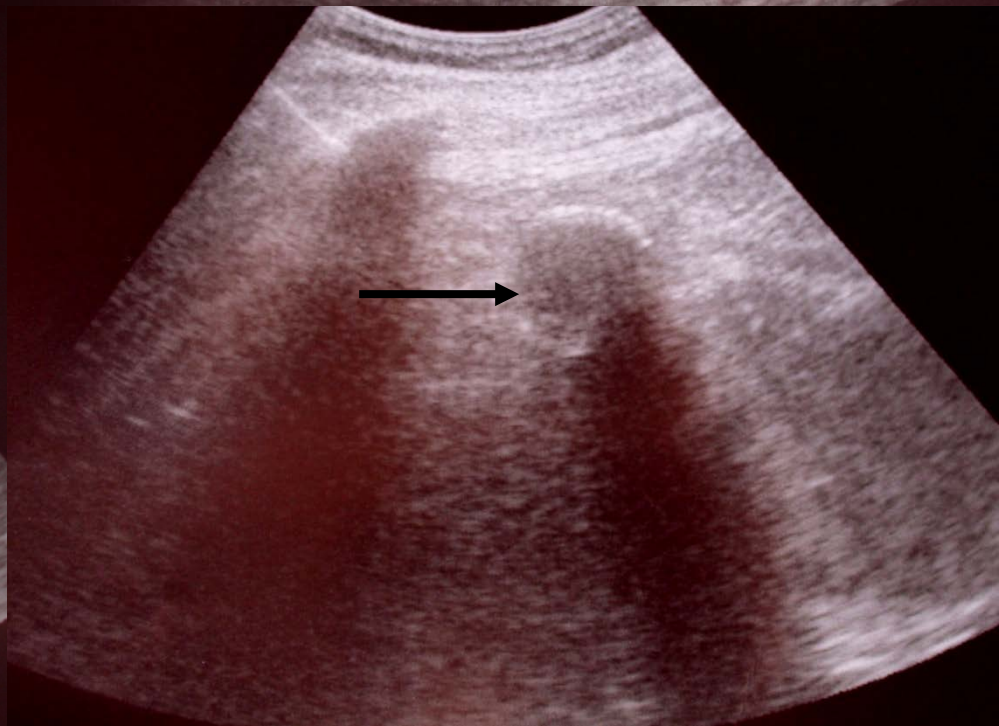
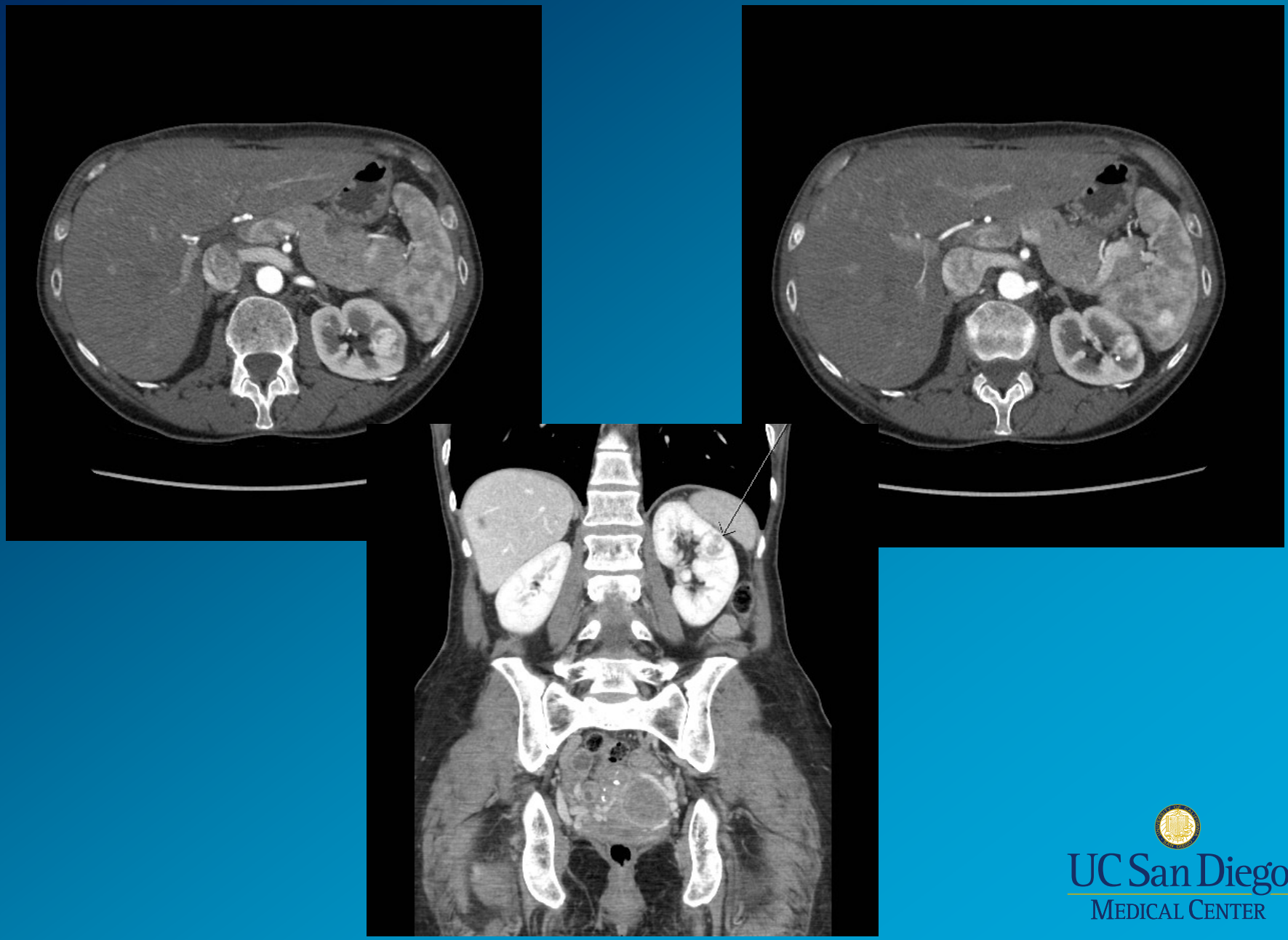





Preprocedural CT



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2.4 Endocare cryoprobes – placed probes at a superior and inferior locations

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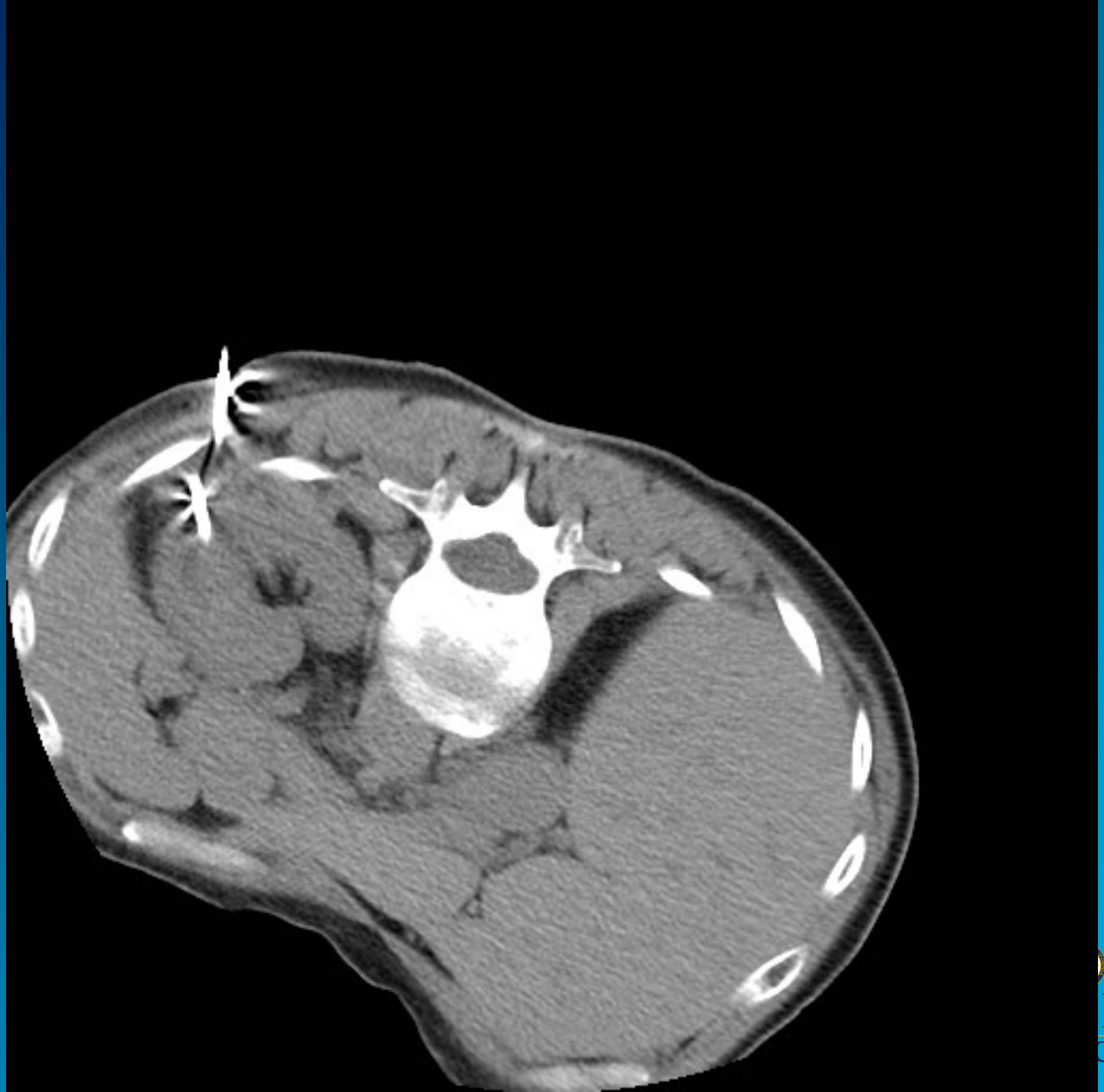

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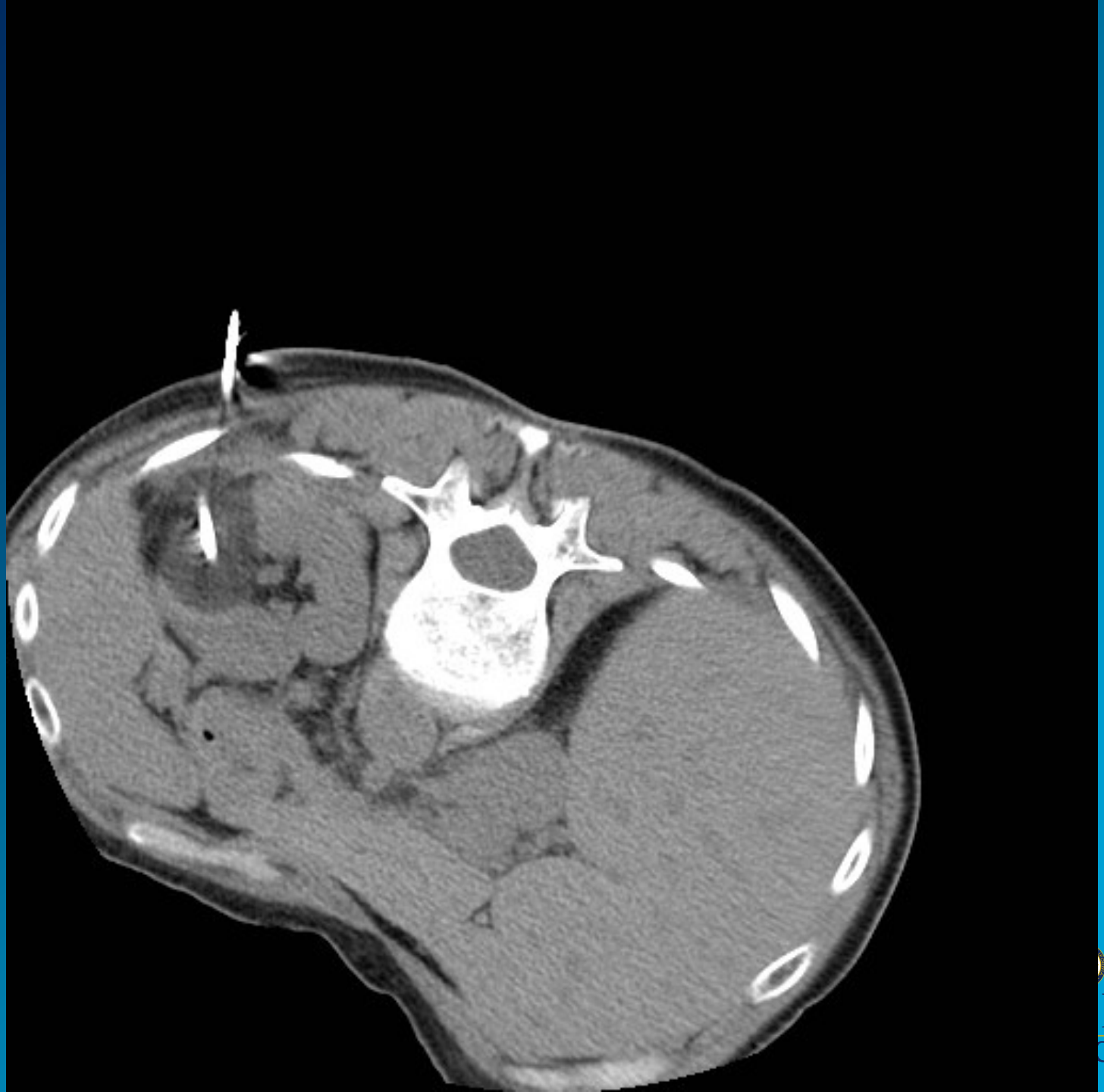
Two Freeze-thaw cycles



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Patient Selection

Nephron sparing surgery:

Partial nephrectomy recommended for all T1 tumors < 7 cm (as long as margins can be removed and expected morbidity is acceptable)

Cryoablation

- Not surgical candidate
- Likely to develop numerous tumors (VHL/elderly)
- Ideal Tumor: small (< 4 cm), partially exophytic, posterior
  - Central and Larger tumors: higher rate of tx failure and hemorrhage
- Relative contraindications: younger patient age, large tumors, hilar/centrally located tumors, and cystic neoplams

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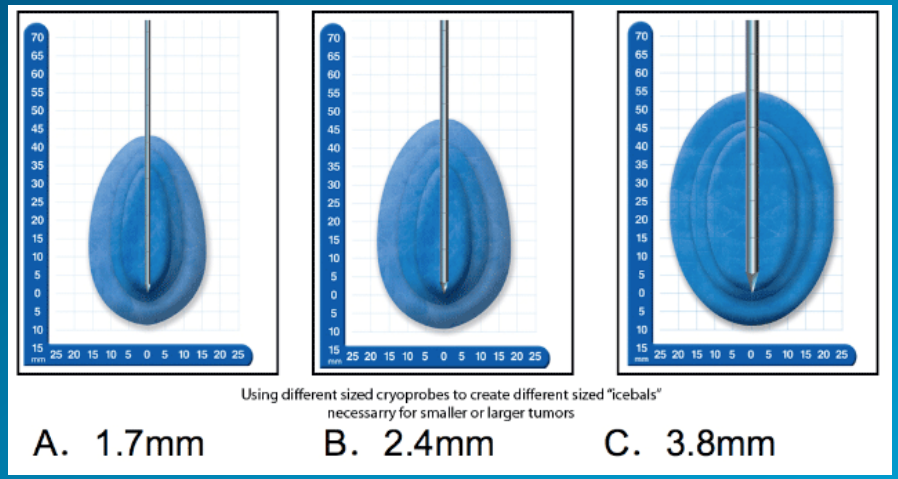
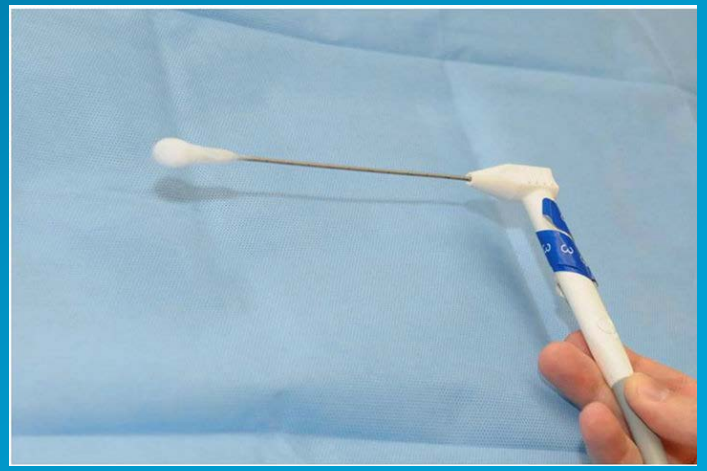
Technique

- Probes should be positioned 1 cm from the tumor margin and 1–2 cm from each other
- The use of *multiple probes creates a synergistic effect* that results in the formation of even more ice
- Two 10 minute freezes (argon) cycle separated by a 8 minute passive thawing (helium) cycle
- Can perform open, lap, or perc
  - Lap: anterior location, larger cryoprobes, surgical hemostasis
  - Perc: posterior location, CT/US with accurate depiction of ablative zone, less invasive, better M&M





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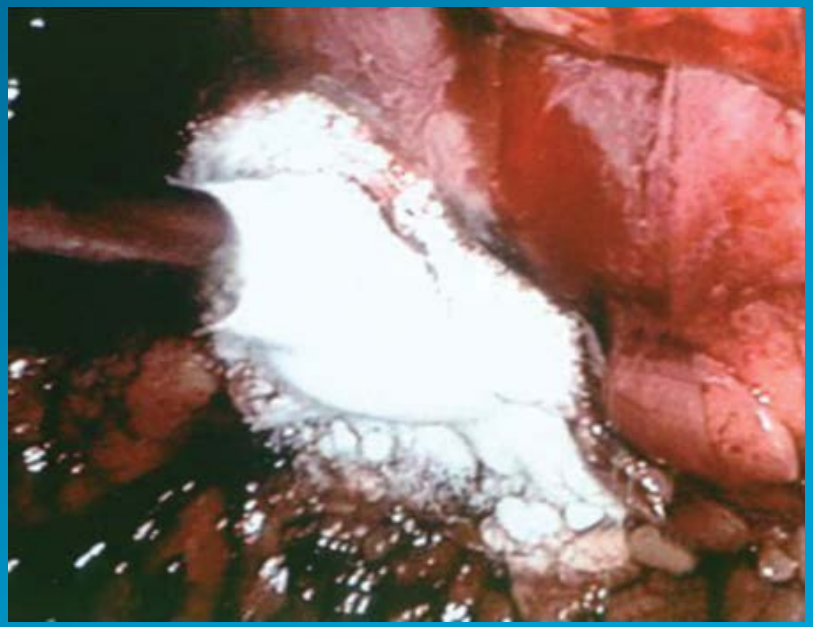
How does it work?

- Synergistic effect
  - intracellular and extracellular ice crystals are directly cytotoxic and lead to cell dehydration and rupture
  - When thawed, there is microvascular occlusion with cell hypoxia resulting in indirect ischemic injury
- Cell death is time and temperature dependent,



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Imaging Follow-up

- Lack of enhancement and decrease in size are reliable indicators of successful cryoablation
  - CT 3/6/12 months, yearly afterwards
  - Benign peripheral contrast enhancement may persist for several months
  - Nodular, irregular or crescent shaped enhancement is suggestive of residual tumor
  - Residual viable tumor is typically T2 hyperintense and enhances.
  - Doubtful cases – targeted biopsy

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Complications

- Hemorrhage
- Urine leak
- UTI
- Pain
- Transient elevation of creatinine
- Incomplete treatment

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Buy et al. Percutaneous Renal Cryoablation: Prospective Experience Treateing 120 Consecutive Tumors. AJR Am J Roentgenol. 2013 Dec;201(6):1353-61. doi: 10.2214/AJR.13.11084

Midterm follow-up study evaluating safety/efficacy of cryoablation

- Prospective nonrandomized – 95 patients (nonsurgical candidates)
- Mean followup: **28 months** (range 6-63 months)
- Mean tumor size: 26 mm (range 10-68 mm)
- 91 treated with CT guidance, 29 with MRI guidance
- **Technical success rate 94%** (two tumors required second cryoablation due to recurrence/residual tumor)
- **Complication rate 7.3%**
  - Bleeding
- Survival: **After 12 months – 96.7% and disease free rate 96.4%**
- Renal function was unchanged even in those with only 1 kidney
- Limitations of study: short follow-up, assessment of tumor ablation based on radiology without pathologic correlation

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Cryoablation vs RFA

- Cryo
- Less painful
- Monitoring ablative zone
- Bleeding

- RFA
- Less bleeding
- Ureteral injury
- Higher recurrence, especially central

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