URETERAL OBSTRUCTION IN SMALL ANIMALS

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VCA
ADVANCED CARE FOR PETS

URETERAL OBSTRUCTION

Vague history and clinical signs

Difficult diagnosis

URETERAL OBSTRUCTION

New therapeutic options

Improved outcomes

Less costly than traditional approach

PATHOPHYSIOLOGY

Ureteroliths: most common

Calcium oxalate: 98% feline, 50-75% canine

Neoplasia: trigone

Stricture: congenital or acquired

Blood stones

Obstructive pyonephritis

Trauma

Polyp

Local abscess

Locally invasive neoplasia

Radiation therapy

PHYSIOLOGIC RESPONSE TO URETERAL OBSTRUCTION

Immediate ureteral pressure increase (peaks 5 hours)

Renal blood flow decreases to 40% of normal within 24 hours

- 20% of normal by 2 weeks

Decrease in GFR

- Contralateral increase
- 7 days post obstruction: 35% permanent loss
- 14 days post obstruction: 54% permanent loss
- Normal dogs
- Over 4 months to reach maximal return to function

Partial obstruction: full return after 4 weeks of obstruction

Early intervention to relieve obstruction is recommended

HISTORY AND CLINICAL SIGNS

FELINE

- Vomiting
- Lethargy
- Decreased appetite
- Acute or chronic weight loss
- +/- signs of uremia
- Uncommon: dysuria, pain

CANINE

- Vomiting
- Lethargy
- Decreased appetite
- Dysuria
- Renal pain
- +/- signs of uremia

Physical Examination

Feline

- +/- Big kidney-Little kidney
- Pale mucous membranes
- Anemia
- Heart murmur

Canine

- Renal pain
- Fever

Laboratory Findings

Feline

- Anemia: 48%
- Azotemia: 83%
- Hyperphosphatemia: 54%
- Hyperkalemia: 35%
- Hypercalcemia: 14%
- Hypocalcemia: 22%

Canine

- Neutrophilia: 63%
- Thrombocytopenia: 44%
- Azotemia: 50%

Urinalysis

Feline

- UTI: 34%

Canine

- UTI: 77%
  - 25% of these had negative culture on pre-op urine

IMAGING

Radiographs

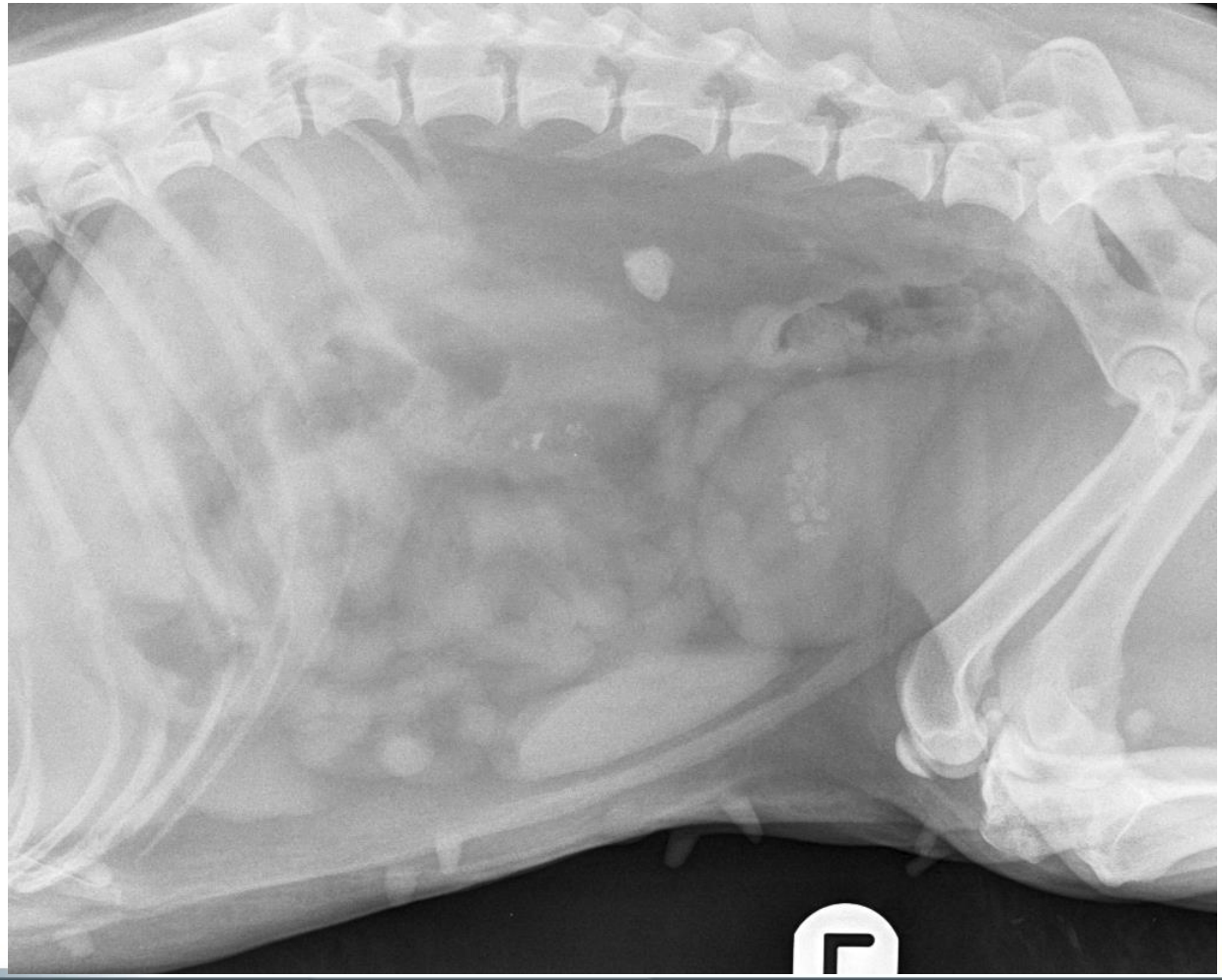
Ultrasound

Percutaneous antegrade pyelography

Computed tomography

GFR studies/scintigraphy

RADIOGRAPHS

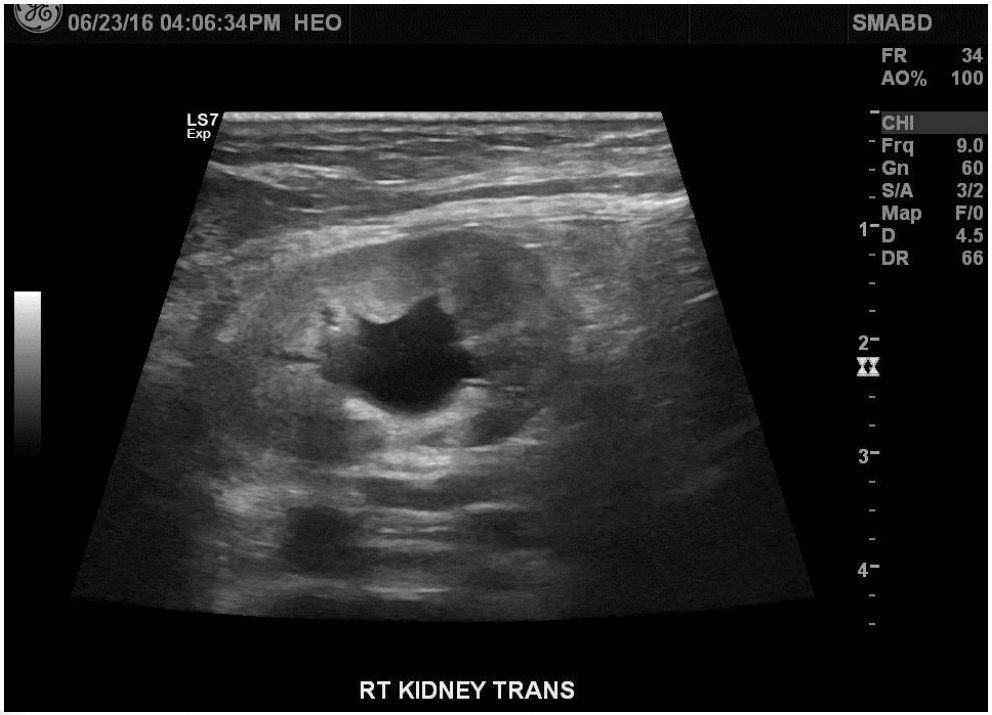


ULTRASOUND

>10mm: likely complete/near complete obstruction

5-10mm: gray zone, dependent on other clinical signs, patient, etc

<5mm: possible early obstruction or partial



PERCUTANEOUS ANTEGRADE PYELOGRAPHY

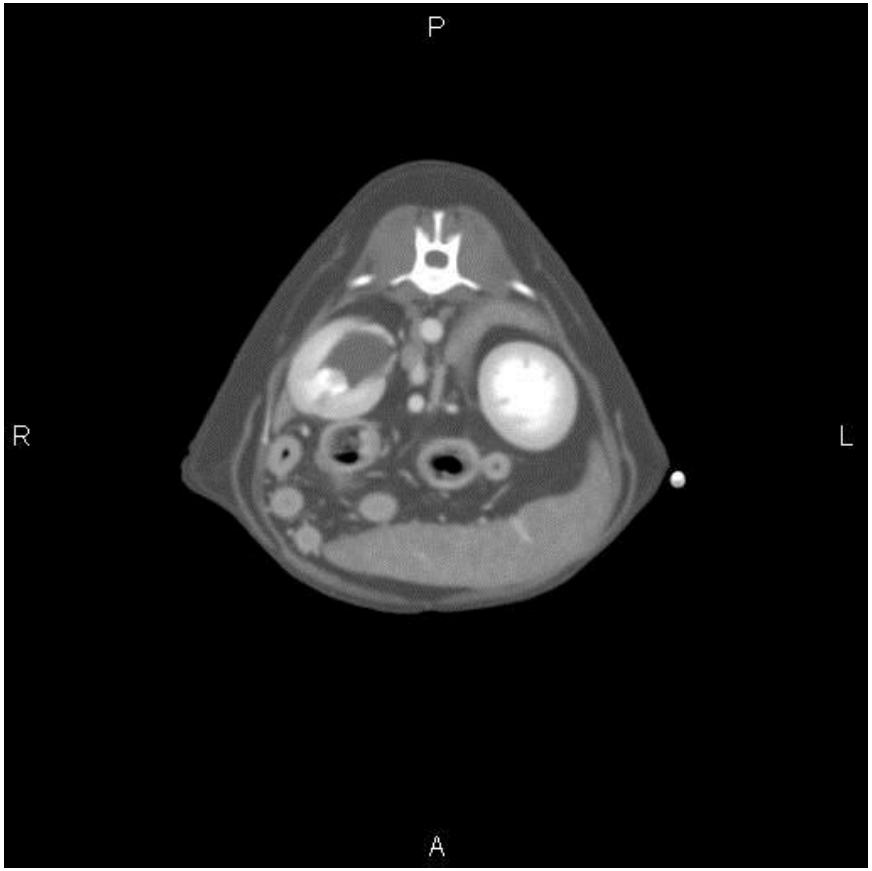
Visualize the renal pelvis and ureter

Localize obstruction

Obtain sample for bacterial culture

Fluoroscopy

CT



GFR STUDIES

Tc99 diethylenetriamine pentacetic acid scintigraphy

Obstructed kidney: typically reduced GFR

Not predictive of return to function

Consider for nephroureterectomy

MEDICAL MANAGEMENT

Stabilization prior to definitive treatment

IV fluid therapy

- Monitor CVP, weight, electrolytes, hydration status
- Caution: fluid overload

Antimicrobial therapy: 77% of dogs have concurrent infections, 34% cats

17% will have movement of ureteral stones

7.7% will pass stone

MEDICAL MANAGEMENT

Mannitol: 1mg/kg/min x 24 hours if no cardiac disease

Discontinue if no improvement after 24 hours

Spasmolytics: Amitriptyline, α-adrenergic blockade (prazosin, tamsulosin), β-adrenergic agonists, glucagon

Anecdotal evidence at best

OUTCOME: MEDICAL MANAGEMENT FELINE

Mortality rate: 33% died or euthanized before discharge

87% fail to see improvement in renal function

If survived to discharge only 30% had improvement in azotemia

13% had improvement with medical management with 7.7% documented stone passage

Unsuccessful for stricture

TIMING TO INTERVENTION

Relieve nephroureteral obstruction as soon as the patient is stable

Save the nephrons!

- 7 days post obstruction: 35% permanent loss
- 14 days post obstruction: 54% permanent loss
- 40 days post obstruction: minimal recovery

SURGICAL MANAGEMENT

Traditional

- Ureterotomy
- Ureteral reimplantation
- Ureteronephrectomy
- Ureteral resection and anastomosis
- Renal transplantation

Interventional

- Ureteral stent
- Ureteral bypass
- Lithotripsy

Anatomy

Feline

- Ureteral diameter: 0.4mm

Canine

- Ureteral diameter 21-30kg dog: 2.0 to 2.5mm

URETEROTOMY

Magnification is essential

Operating microscope vs. loupes

Microsurgical instruments and suture (7-0 to 10-0)

Caution with suction: ureteral edema

Caution with electrocautery: lateral thermal spread

Stent placement more common

URETERAL REIMPLANTATION

End-to-Side Neoureterocystostomy

Distal ureteral masses, extramural ectopic ureters, distal ureteroliths

Magnification

URETERAL RESECTION AND ANASTOMOSIS

Uncommon procedure

Requires operating microscope and two experienced surgeons

Luminal disparity: dilated proximal ureter and normal distal ureter

3-4 weeks before coordinated peristalsis returns to the ureter

OUTCOME: TRADITIONAL SURGERY FELINE

8% confirmed uroabdomen, but 34% had abdominal effusion

7% persistent ureteral obstruction

17% failure to improve renal function

13% revision surgery

3% fluid overload

25% did not survive to discharge

40% reobstruction within 1 year

50% mortality at 1 year

OUTCOME: TRADITIONAL URETERAL SURGERY CANINE

21% failure renal function improvement

15% worsening of renal function

13% second surgery: recurrence, stricture

43% persistent renal dysfunction

43% recurrent or persistent UTI

25% with positive stone culture had negative pre-op urine culture

25% died or euthanized due to renal disease

SAVE THE NEPHRONS

>30% of cats will develop chronic kidney disease

Indication for nephroureterectomy:

Renal neoplasia

Degree of pyelectasia and obstructed GFR do not correlate to post-operative prognosis

URETERAL STENT

Save the nephrons!

62% of cats with ureteral obstruction had nephroliths

40% of cats re-obstruct after ureterotomy

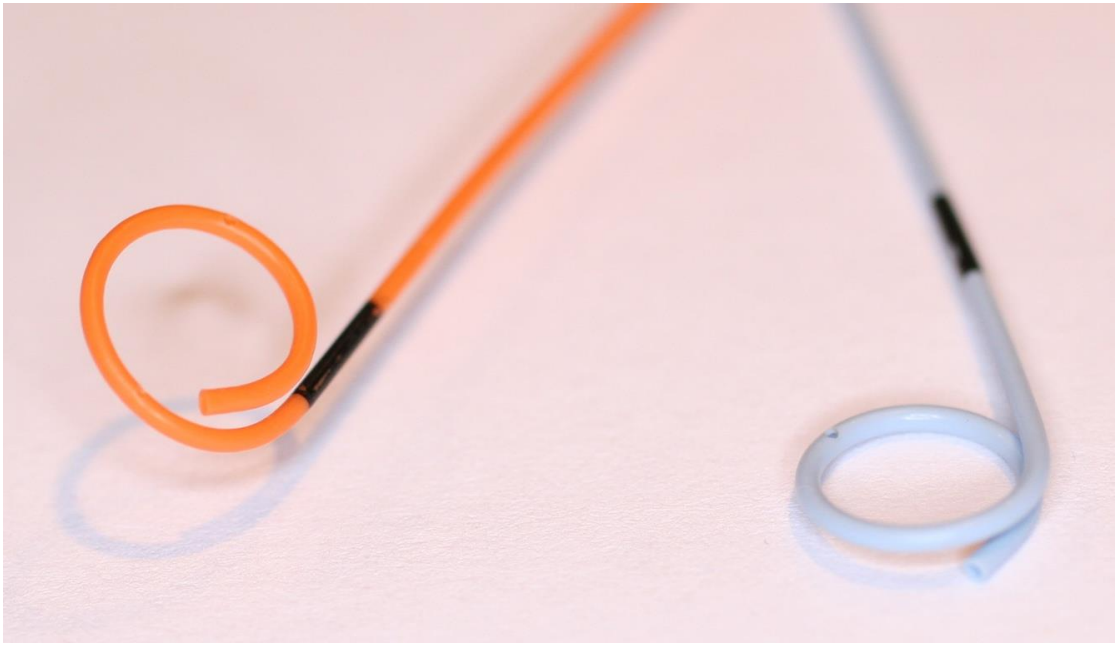
URETERAL STENT

Proximal and distal pigtail for retention

Inner diameter - .018”, .025”, .035”

Outer diameter - 2 Fr, 3.7 Fr, 4.7 Fr

Hydrophilic multi fenestrated radiopaque shaft



URETERAL STENT

Double pigtail

- Renal pelvis
- Urinary bladder

Multi fenestrated radiopaque

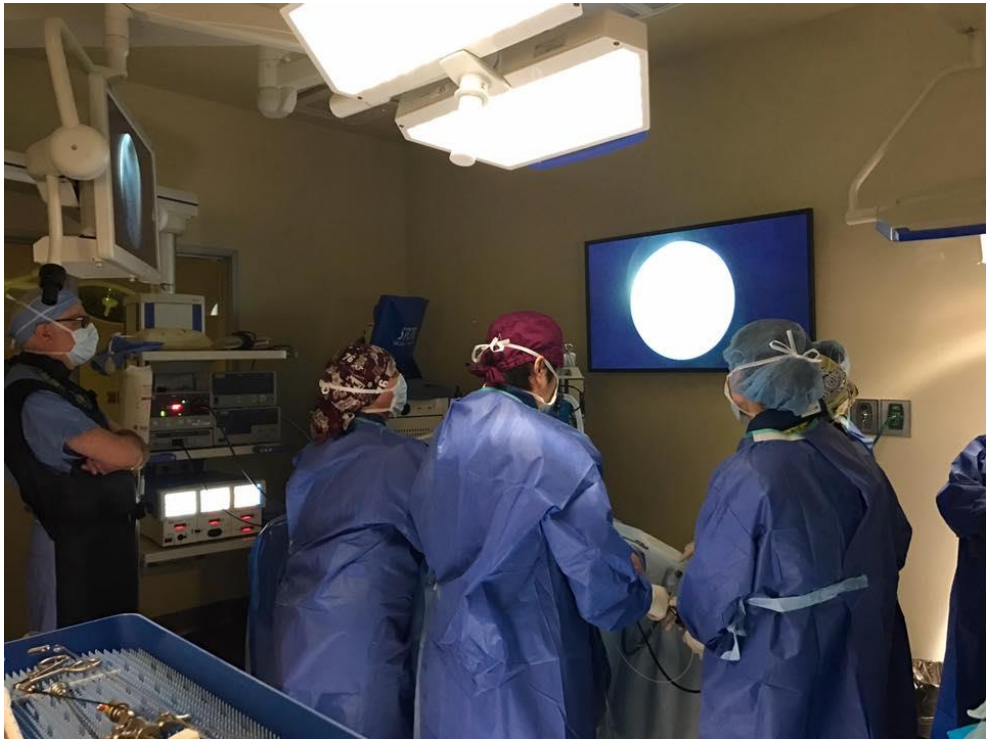
Fluoroscopic guidance

Multiple approaches

- Open antegrade or retrograde
- Cystoscopic retrograde
- Percutaneous antegrade

URETERAL STENT EQUIPMENT

- Ureteral stent, guidewire, dilator
  - Size dependent on patient
- Fluoroscopy
- Contrast
- Remainder depends on approach
  - Ultrasound
  - Laparotomy
  - Cystoscopy



CYSTOSCOPIC RETROGRADE

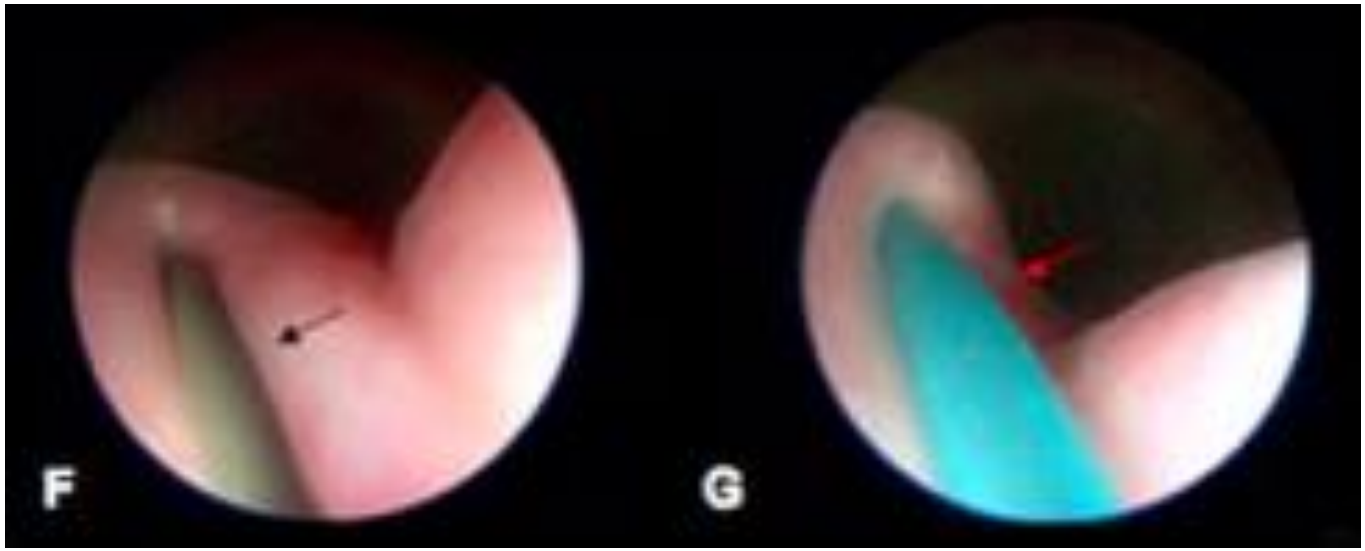


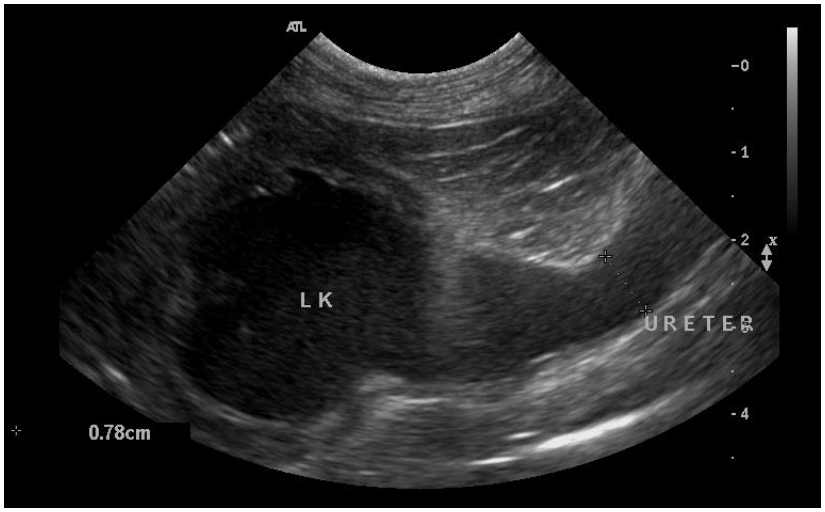
Image courtesy of Dr. Tracy Hill

URETERAL STENT

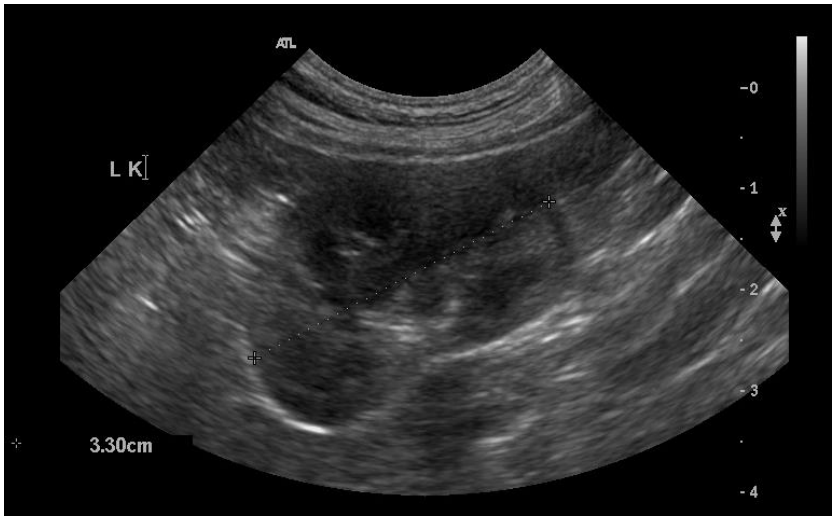
Image courtesy of Dr. Chick Weisse

SAVED NEPHRONS

Obstructed



2 weeks post stent placement



OUTCOME: URETERAL STENT FELINE

Cause: 75% stones, 24% stricture, 1% obstructive pyonephrosis
17% Ureteral penetration with guidewire intraop but no uroabdomen postop
6.7% leakage when concurrent ureterotomy
17% fluid overload postop
6% pancreatitis
5% failure of creatinine to improve
7.5% died prior to discharge: CHF, pancreatitis
38% dysuria: 98.4% responsive to prednisolone
13% postop UTI vs 34% preop UTI
23% reobstruction
18% chronic hematuria
6% stent migration
27% require stent exchange

OUTCOME: URETERAL STENT CANINE

Cause: 55% ureteroliths, 40% neoplasia, 5% strictures

<1% ureteral perforation, leakage, tear

1 patient did not survive to discharge

7% persistent hematuria

9% reobstruction

13% UTI postop vs 59% UTI preop

6% migration

2% encrustation

1 stent fracture

1 dysuria

URETERAL BYPASS

Subcutaneous Ureteral Bypass (SUB)

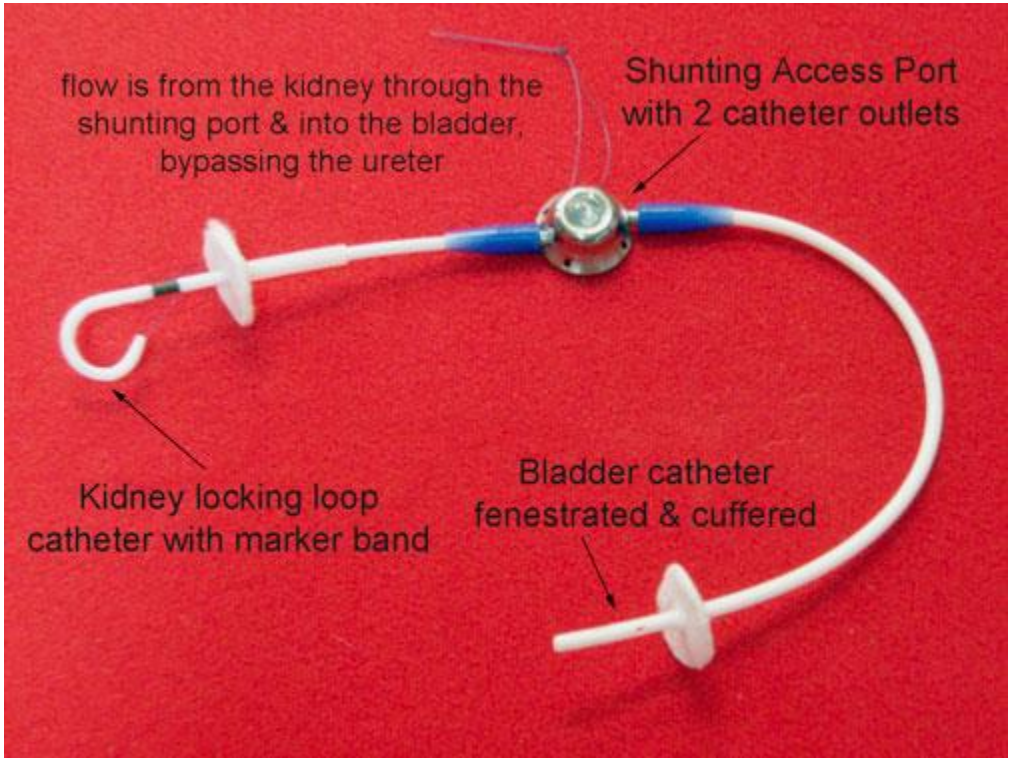
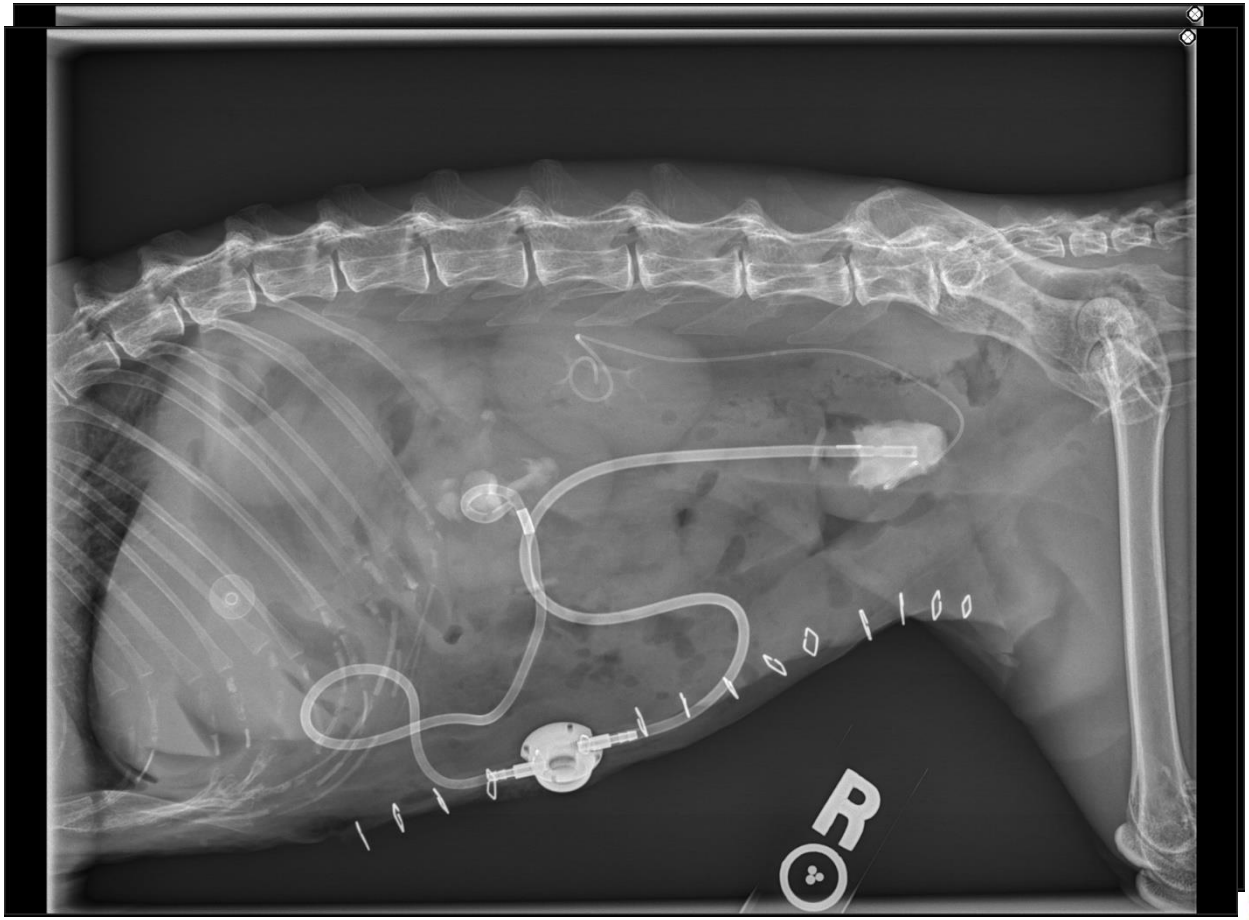


Image: Norfolk Vet Products

URETERAL BYPASS



OUTCOME: SUB FELINE

Cause: 20% stricture, 76% ureteroliths, 4% obstructive ureteritis

3.5% kinking

5% leakage: required replacement device

10% device occlusion: managed conservatively

3% failure of creatinine to improve

5.8% failed to survive to discharge

Not related to surgical complications

15% postop UTI vs 35% preop

TO SUB OR TO STENT

2 retrospective studies

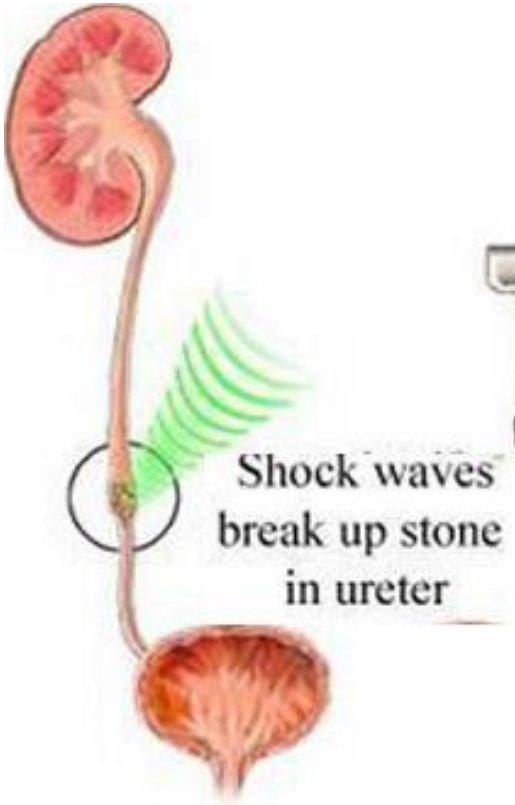
- No difference in survival to discharge or hospitalization time
- Complications
  - 10% stent: vesiculoureteral reflux, dysuria
  - 0% SUB

Ureteral stricture

UTI: resistance?

Follow up: more rechecks with SUB

EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY



Extracorporeal shock wave lithotripsy (ESWL) machine

EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY

32 dogs

90% success

30% require repeat treatments

Ureteral stenting improves outcomes

POSTOPERATIVE CARE

- Esophageal feeding tube
  - Almost all cats, severely ill dogs
  - Allows for nutritional support, water w/o Na load
- Central line
  - CVP monitoring
    - Fluid diuresis + CKD = difficult fluid balance
- Urinary catheter
  - In more critical patients
  - More accurately monitor ins/outs

POSTOPERATIVE CARE

Maintain fluid balance

- Post-obstructive diuresis: 3-5X maintenance or more
- Better slightly behind than overloaded
- Body weight 3-4x per day

Nutritional support

Pain management

Antibiotics if appropriate

Monitor electrolytes, BUN, Cr q24h

PROGNOSIS

Variable depending on multiple factors:

Chronicity of obstruction

Degree of obstruction

Species

Cause for obstruction

OUTCOMES: SYNOPSIS

	Medical Management	Surgery	Interventional Radiology
Mortality	33%	25%	6%
No improvement creatinine	87%	19%	3%
Reobstruction	92%	38%	14%