



**PATIENT**

Ember Massey

**SPECIES**

Feline

**BREED**

Domestic Shorthair

**SEX**

Spayed Female

**AGE**

4 years

**WEIGHT**

13 lbs

**INTERPRETED BY**

Eric Lindquist, DMV  
DABVP, Cert. IVUSS

**IMAGING PERFORMED BY**

Dr. Ebersole

**HOSPITAL NAME**

Scanvet

**REFERRING VET**

Dr. Walsh

**INVOICE**

91365

**DATE**

8/19/21

**PRESENTING CLINICAL SIGNS**

History: Cystotomy 6 days ago, removed 12 uroliths. Bladder difficult to exteriorize, fat pockets and had an unusual vascular ligament/attachment from ventral surface extending cranially. Bladder digitally felt clear of further stones and was flushed copiously. Recurrence of hematuria, and radiograph shows likely urethral stone/s and possible bladder stones (unclear if embedded in the bladder wall).  
Abnormal PE/Chem/CBC/UA Results: PE: BS 7/9. Urolith analysis pending.

**ULTRASONOGRAPHIC EXAMINATION OF THE ABDOMEN**

**Urinary System**

The **urinary bladder** revealed two separate bladder calculi measuring 0.37 cm and 0.38 cm. There was a urethral calculus that was 1.0 cm from the cystourethral junction and measured 0.3 cm. The second urethral calculus noted in the distal pelvic urethra approximately 2.0 cm distal from the cystourethral junction. This calculus measured 0.33 cm. Apical bladder wall thickening was noted. There was also a dorsal bladder thickening that is likely from surgical healing and involuted suture pattern.

The right kidney was irregular in contour with mild pericapsular inflammatory pattern and ill-defined renal pelvis. The patient may be passing more calculi from the kidneys to the bladder and pelvic urethra. The right kidney measured 4.11 cm with minor pyelectasia. The left kidney appeared normal in size and contour measuring 4.1 cm.

**Adrenal Glands**

Both **adrenal glands** were visualized and recognized as having normal shape, size, position and echogenicity for this breed. The phrenic vasculature, glandular echogenicity and detail were unremarkable. Capsule, cortex, and medullary definition were normal for this age patient.

**Spleen**

The **spleen** presented a smooth homogeneous parenchyma hyperechoic to liver and renal cortical parenchyma. The capsule was smooth without noticeable expansion or deviation from within the spleen or adjacent pathology. The splenic vasculature demonstrated normal volume without signs of congestion or thrombosis. No sonographic evidence of acute or chronic inflammatory, neoplastic, or infarctual changes was noted.

**Liver**

The **liver** images submitted revealed subjectively normal liver size, contour, and structure. Parenchymal echogenicity was naturally coarse and hypoechoic to the spleen. Vascular and biliary tracts were of normal volume with no evidence of congestion. The gallbladder presented acceptably thin walls with primarily anechoic content. The cystic and common bile ducts were normal. No pathological hepatic lymphadenopathy was evident. No overt structural evidence of inflammatory, infiltrative or regenerative pathology was evident.



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**Gastrointestinal**

Examination of the **gastrointestinal tract** revealed a stomach and intestine free of stasis, of normal wall thickness, acceptable curvilinear mural detail, and peristaltic activity. Small and large intestine demonstrated normal luminal chyme and stool consistency respectively. Soft stool was noted in the descending colon.

**Pancreas**

The base and limbs of the **pancreas** were observed to be largely isoechoic to surrounding omental fat. Pancreatic duct and capsular contour were acceptably normal and parenchyma respected normal curvilinear patterns. No overt evidence of active inflammatory or neoplastic disease was noted.

**ULTRASONOGRAPHIC FINDINGS**

Bladder and urethral calculi with pyelonephritis pattern in the right kidney. The right kidney may have recently passed calculi, which is now in the distal urinary tract.

Apical bladder wall thickening.

**INTERPRETATION OF THE FINDINGS & FURTHER RECOMMENDATIONS**

I recommend repeating cystotomy with normal and retrograde flush. The apical wall thickening should be investigated or resected at the time of surgery. This may be residual urachal remnant.

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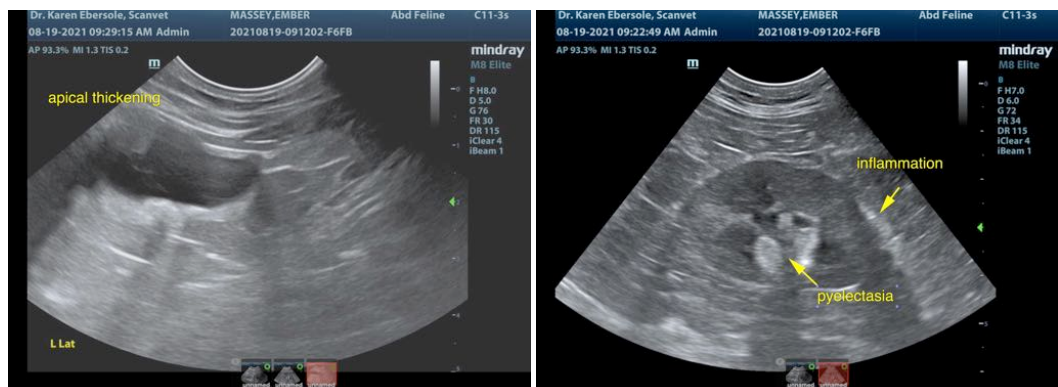
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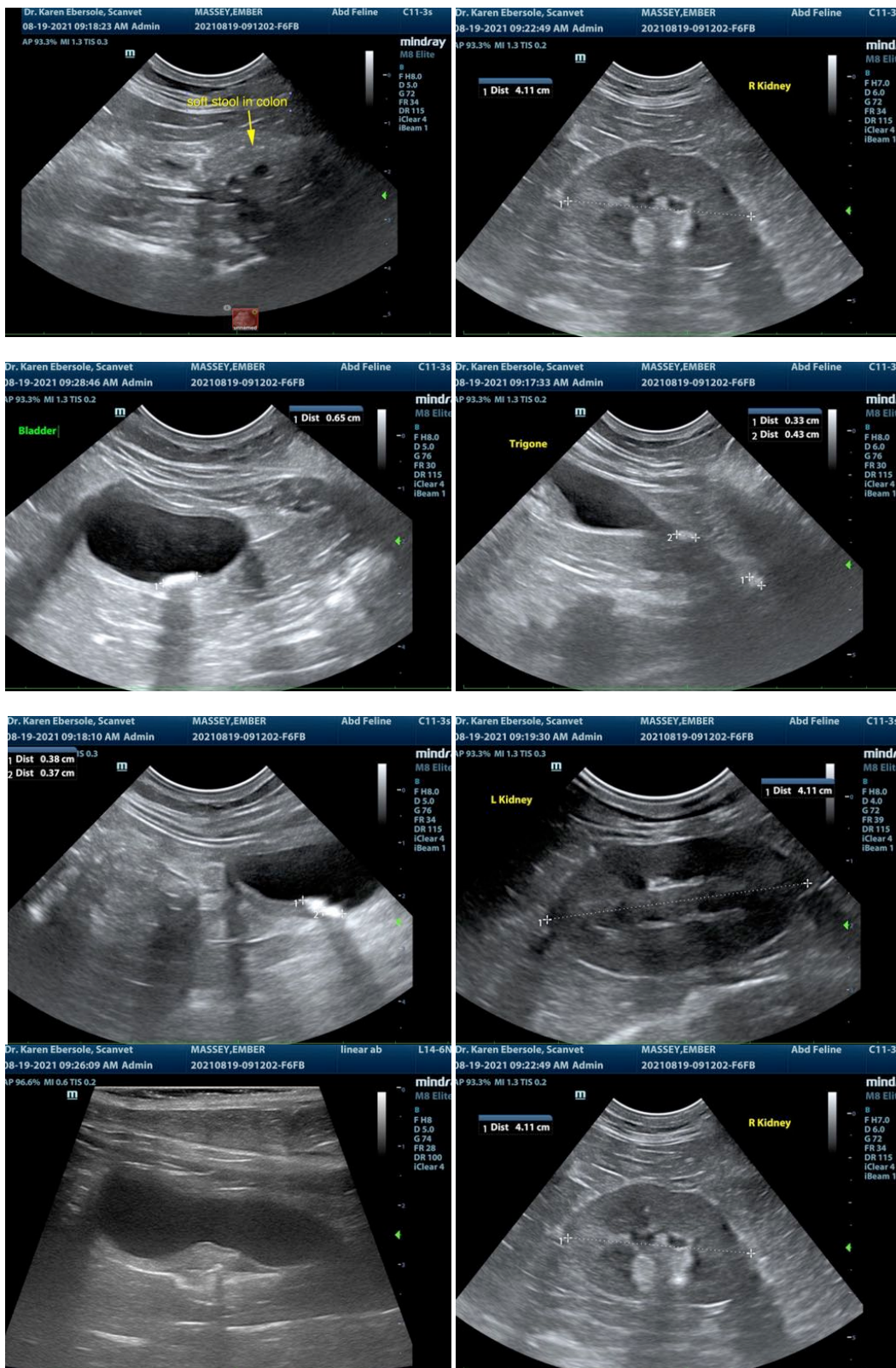
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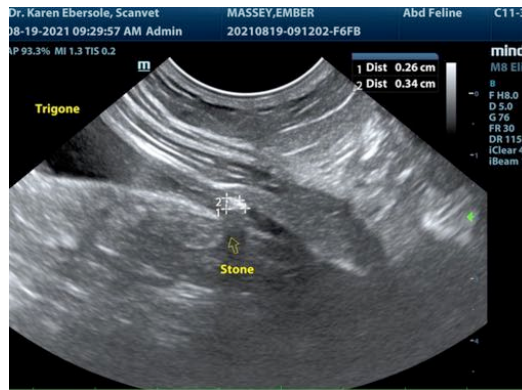
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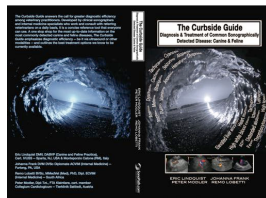
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The information and recommendations provided are based on the images presented by the referring veterinarian. No evaluation can be communicated regarding pathology that was not visible in the image/video clips provided.

Thank you for this referral. If the clinical or image interpretation does not parallel your findings or if I can be of any further assistance please contact me.

Eric Lindquist, DMV, DABVP, Cert. IVUSS, CEO of SonoPath.com  
info@SonoPath.com



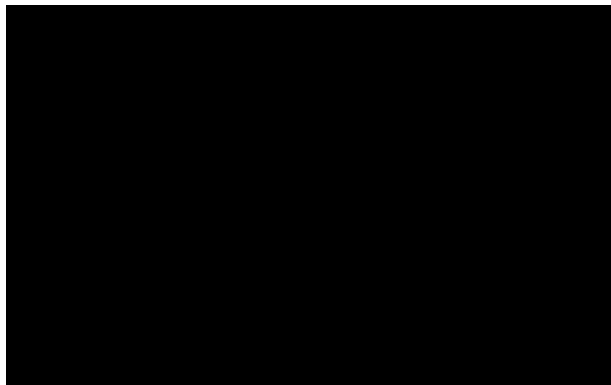
The following is an applicable excerpt from the *Curbside Guide to Diagnosis & Treatment of Sonographic Disease* offered by [SonoPath.com](http://sonopath.com) Lindquist, Frank, and Modler.

An essential quick guide for every general practitioner and sonographer.

<https://sonopath.com/products/curbside-guide-editing-due-release-12012015>

**Urolithiasis**

<http://www.sonopath.com/Urolithiasis>



Long axis of the left kidney in a cat with an obstructed renal calculus resulting in hydronephrosis. Note the moderate dilation of the renal pelvis and atrophy of the renal medulla. Echogenic sediment is seen in the dependent portion of the dilated renal pelvis. Also note the strongly hyperechoic renal calculus with acoustic shadowing.



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**Description:** Urolithiasis is defined as the formation of urinary calculi from the less soluble crystalloids present in urine as a result of multiple congenital and/or acquired physiological and pathological processes. Found in the urinary tract, uroliths are organized concretions comprised primarily of organic or inorganic crystalloids and a much smaller organic matrix. When 70% or more of the urolith is composed of one type of crystal, it is named for that crystal; secondary crystalloids can comprise up to 30% of its total weight. The urine is commonly supersaturated with crystalloids; however, evidence of individual crystals in the urine does not mean the animal is necessarily at risk for urolithiasis. Supersaturation of urine with crystalloids depends on the interaction of mineral elements in the urine, which are derived from the amount of solute ingested and excreted, as well as the volume of urine produced.

Urolithiasis should not be treated as a final diagnosis, but rather understood as a sequel of one or more underlying abnormalities. In dogs and cats, the majority of uroliths are found in the bladder or urethra. Urolith formation is often erratic and unpredictable, as several interrelated physiological and pathological factors are usually involved. Urolithiasis can also coexist with neoplasia. Bladder or urethral carcinoma often contains dystrophic mineralization within the neoplastic tissue that can be mistaken on radiographs for simple urolithiasis. Ultrasound examination can help differentiate urolithiasis from dystrophic mineralization associated with carcinoma. Conditions that contribute to crystallisation and urolith formation include:

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- A high concentration of crystalloid material in the urine
- Urinary retention of crystalloid material
- Urinary stasis
- A urine pH that favors conditions for crystallisation
- UTIs, which can lead to the development of uroliths
- Diet
- Metabolic factors

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**Clinical Signs:** Clinical signs are dependent on the number, type, and location of the urolith within the urinary tract. Because the majority of uroliths occur in the urinary bladder, one frequently observes signs of cystitis. In male dogs, small uroliths may lodge within the urethra, usually at the caudal end of the os penis. This results in complete or partial obstruction of the urethra, triggering bladder distension and postrenal azotemia. Occasionally, the urinary bladder or urethra may rupture resulting in ascites or subcutaneous perineal fluid accumulation, respectively, as well as postrenal azotemia. Unilateral renal uroliths may be asymptomatic or associated with hematuria and chronic pyelonephritis. Because bilateral renal uroliths are usually associated with pyelonephritis or obstruction, they often lead to renal failure.



<b>PATIENT</b>	Ureteral uroliths may be asymptomatic or associated with hematuria or abdominal pain.
Ember Massey	Unilateral, complete obstruction leads to a unilateral hydronephrosis with no evidence of decreased renal function.
<b>SPECIES</b>	
Feline	<b>Diagnostics:</b> Because uroliths can cause trauma in the urinary tract, urinalysis often reveals proteinuria and hematuria. Crystalluria may be observed when uroliths are present and may also occur as an incidental finding without uroliths; however, if both exist concurrently, the identity of the crystal is usually the same as that of the urolith. Ultrasonography and survey and contrast radiographs can be used to diagnose and localize uroliths. Conducting a urine culture is important to exclude the possibility of a concurrent UTI. Once a urolith is collected, it must be quantitatively analyzed to determine its composition, which will help dictate preventative therapeutic measures. A retrospective review of 25,499 uroliths from 1985-2006 showed their composition to be comprised of one or more of the following: struvite, calcium oxalate, urate, apatite, brushite, cystine, silica, potassium magnesium pyrophosphate, sulfa drug, xanthine, and newberyite. Over the study period, there was a significant decrease in the proportion of struvite-containing uroliths and a significant increase in the proportion of oxalate-containing uroliths. There were also significant nonlinear decreases in the submission of urate-, silica-, and cystine-containing uroliths.
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<b>INTERPRETED BY</b>	<b>Treatment:</b> Cystostomy and/or urethrotomy are often used in the management of urolithiasis. It is important to remember that surgery is often associated with a high rate of recurrence if the underlying cause is not addressed. The medical dissolution of struvite, urate, and cystine uroliths is often effective; however, it requires a high degree of owner compliance over a long period of time (weeks to months). Both dogs and cats should be fed diets appropriate to the type of urolith they have. In cases of ureteral stones, ureteral stenting can be performed to divert the urine from the renal pelvis into the urinary bladder. Stents are soft and biocompatible, made from a polyurethane-type material, and have a double pigtail shape, which allows the proximal pigtail loop to curl inside the renal pelvis. The shaft travels through the entire ureteral lumen, with the distal loop sitting inside the urinary bladder. These loops prevent stent migration and protect the entire ureter from obstruction. The ureteral stent results in passive ureteral dilation, which can permit passage of a previously obstructive ureterolith or allow urine to flow around the stones and the stent. A normal feline ureter is around 0.3-0.5 mm in diameter, and after a ureteral stent has been in place for some time (a few days up to approximately two weeks), the ureter diameter can reach up to 1.5 mm. In female cats, access is either attempted via cystoscopy in a retrograde manner or surgically in an antegrade manner; however, in most cats, the procedure is done surgically via a ventral midline incision. More recently, the subcutaneous urethral bypass (SUB) technique has also been employed to treat obstructive urolithiasis; it represents an even less invasive option.
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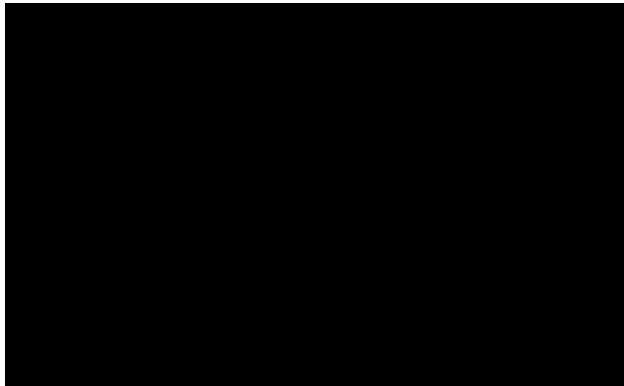
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Long axis of the left ureter in a cat with a hydroureter due to obstructive ureteral calculi. Note the moderate dilation and thickened wall of the ureter (arrow). Irregular shaped obstructive calculi with acoustic shadowing are seen in the image center. Also note the presence of additional echogenic material proximal to the obstruction. The anechoic tubular structure deep to the ureter is the abdominal aorta.

**SEX**

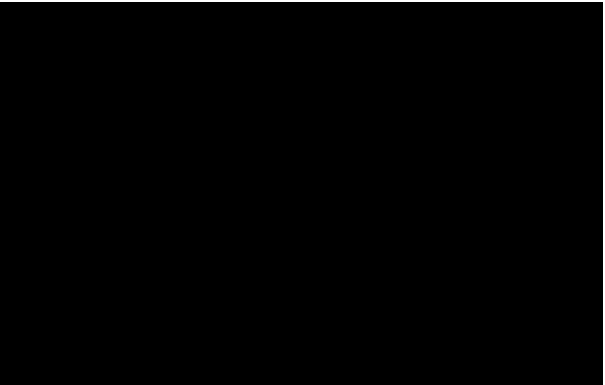
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Long axis of the bladder neck and urethra in a cat with an urethral calculus. Note the hyperechoic surface of the stone (between calipers) and the acoustic shadowing deep to the calculus. The pelvic urethra in a cat can be imaged, as a rule, at least 2–3 cm caudal to the cystourethral junction and often farther.

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**References:**

Berent A. Management of feline ureteral obstructions: an interventionalist's approach. Proceedings from the American College of Veterinary Surgeons Symposium, Chicago, IL, November 1-5, 2011.

Cannon AB, Ruby AL, Westropp JL, et al. Evaluation of trends in urolith composition in cats: 5,230 cases (1985-2004). *J Am Vet Med Assoc* 2007;231:570-76.

Fisher JR. Acute ureteral obstruction. In: August JR, ed. *Consultations in feline internal medicine, 5<sup>th</sup> ed.* Philadelphia PA: WB Saunders, 2005:379-87.

Osborne CA, Lulich JP, Kruger JM, et al. Canine uroliths, feline uroliths, and feline urethral plugs from 1981 to 2007: perspectives from the Minnesota Urolith Center. *Vet Clin North Am Small Anim Pract* 2009;39:183-97.