

Subclinical Bacteriuria

- The presence of bacteria in urine as determined by a positive culture from a properly collected urine specimen, in the absence of clinical evidence of infectious urinary tract disease
 - NOT just on sediment exam
- Reported in 2.1-12% of healthy dogs
 - 15-74% in some populations with predisposing factors
 - DM, obesity, parvo, IVDD, immunosuppressive therapy
- Cats – reported in 1-13% of healthy cats
- No evidence of association with going on to develop urinary tract signs or alter survival without treatment

Journal of Feline Medicine and Surgery, (2019) 21, 1023–1038

URINARY TRACT INFECTION AND SUBCLINICAL BACTERIURIA IN CATS **A clinical update**

Roswitha Dorsch, Svenja Teichmann-Knorrn and Heidi Sjetne Lund

Subclinical Bacteriuria

- What do the Human Doctors do?
 - They don't treat!
 - Even in high-risk groups!!
 - Even with malodorous urine or with pyuria...
 - Largely focused on antimicrobial stewardship
 - They do treat if there is urological surgery planned
- But what happens when they do?
 - They eliminate the current bacteriuria but...
 - Patients are quickly recolonized
 - Often with significantly higher recurrence rates than those not treated
 - Treated patients often have higher rates of AMR *E. coli* in subsequent UTIs

Subclinical Bacteriuria - Diagnosis

- Why are you looking?
 - No indication to culture in animals that lack lower urinary tract signs when there is no indication to treat if a positive result is found
 - So, not as part of annual wellness visit
 - Even in patients with DM or HAC
 - But indicated as part of an investigation of PU/PD, for instance
- Cell count cannot differentiate subclinical from cystitis
- Does not depend on the presence or absence of pyuria
- Retesting not recommended
 - Don't need to "see if its gone" or "if its still there" if no indication to treat!

Subclinical Bacteriuria – Treatment????

- In patients where it is unclear if there are clinical signs
 - Treat with 3-5 days of an appropriate antimicrobial
 - If no response, then a true infection is unlikely and stop treatment
- Patients that *can't* display signs
 - Requires clinical judgement
 - Paralyzed patients or those that can't mount a fever response
- If pyuria present, we USED to recommend treatment
 - In people, this is not recommended
 - No evidence in veterinary medicine that suggests we should act differently
- In the VERY RARE event that the urinary bacteria is thought to be a nidus for extra-urinary infection

Subclinical Bacteriuria – Treatment???

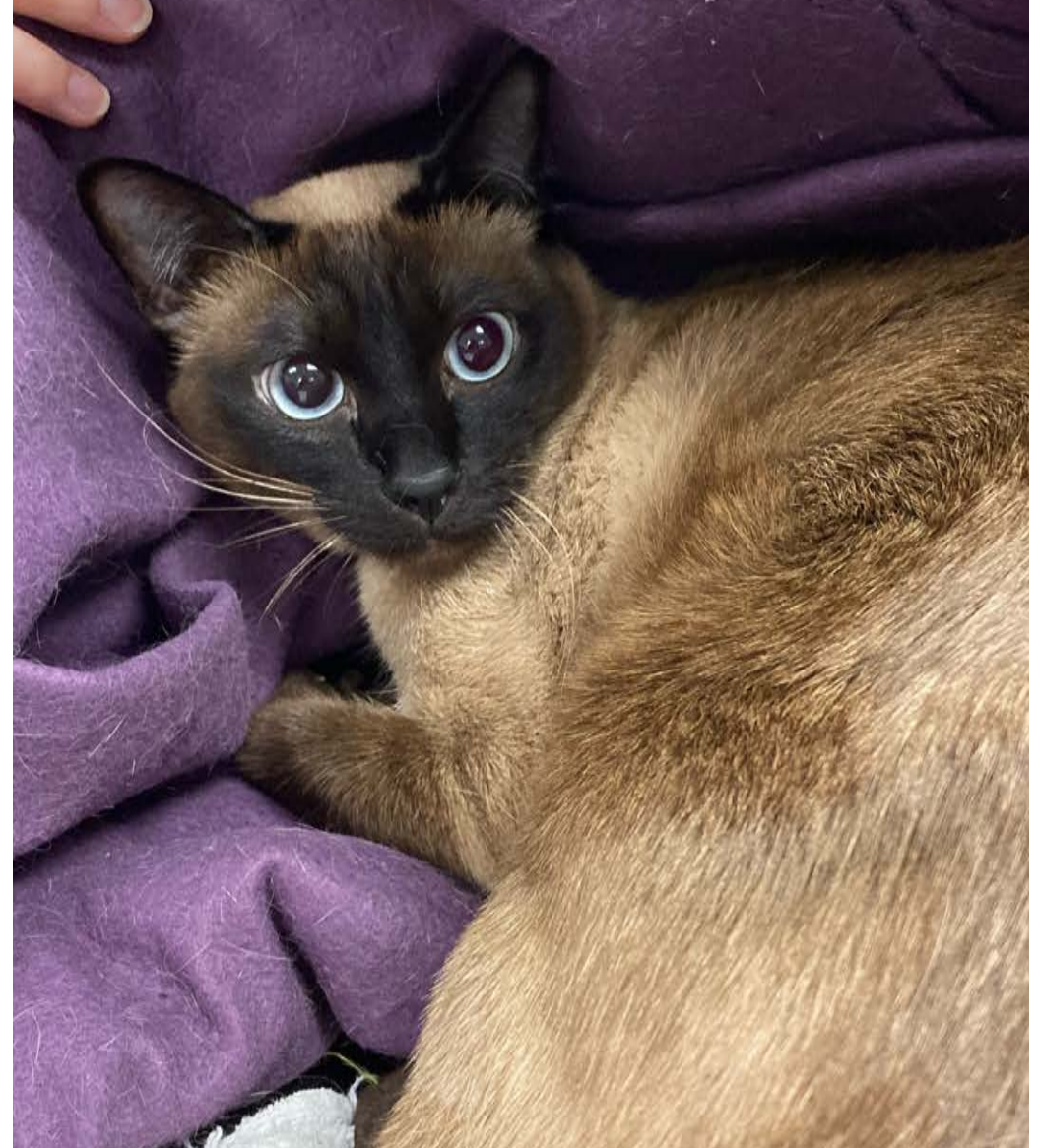
- Multidrug resistant organisms
 - This should NOT prompt treatment
 - They do not do more damage or make one more likely to develop a true infection
 - Some anecdotal evidence that, over time, these bacteria may be replaced by more susceptible organisms if treatment is withheld
- Plaque-forming and urease producing organisms
 - Can be associated with encrusting cystitis and urolith formation
 - IF those things are present, it is a reason to treat
 - Unknown if they will cause these things to happen
 - Can be difficult to treat even when we want to... (*Corynebacterium*)

Subclinical Bacteriuria – Treatment???

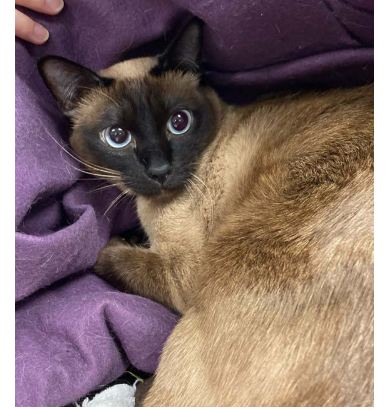
- What if the patient previously had subclinical bacteriuria, but is now showing clinical signs?
 - Depends on the timing since the last culture, but it is unknown how likely it is to be the same organism causing the clinical signs
 - Recommend reculture to direct therapy appropriately
- What about supplements?
 - Cranberry extracts, probiotics
 - No evidence that these will prevent or resolve subclinical bacteriuria
 - No real contraindication either

Teemo

- 3-year-old MN Siamese
- Referred for recurrent UTIs
- Previous History
 - Initial episode almost 2 years ago
 - Stranguria
 - ER visit – Tx supportive care, no ABs
 - Follow up
 - CBC/Chemistry – mild increase in creatinine (low 200s) and SDMA
 - UA – pyuria, bacteriuria



Teemo



- Recent History

- Dec 2021

- Owners had big event at home and Teemo developed stranguria after this
 - Seen by an ER clinic and he had small bladder, treated supportively for FIC

- Follow up UAs and culture

- Bacteriuria, pyuria
 - The previous elevated creatinine persisted
 - Treated with prolonged course of Clavamox for possible pyelonephritis (6 weeks)

- Last week:

- Saw me – owners report him as being completely normal at home. Only urinary signs had been those two episodes, nothing persistent at home

- Physical Exam

- Normal

Lab Results

1/10/22 (Order Received)
1/13/22 5:53 AM (Last Updated)

1/7/22 11/14/21

TEST
Collection **CYSTOCENTESIS**
Colour Yellow

FREECATCH	CYSTOCE...
Yellow	Yellow
Cloudy	Clear
1.016	1.030
6.5	8.0
2+	1+

Creatinine low 200

a CYSTOCENTESIS

Status: FINAL

Isolate 1: Escherichia coli - >1x10E5 CFU/ml

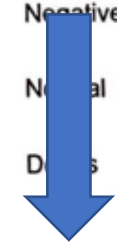


	Isolate 1	MIC
AMOXICILLIN	S	<=2
AMOXICILLIN-CLAVULANIC ACID	S	<=2
CEPHALEXIN	S	8
CEFPODOXIME	S	<=0.25
CEFOVECIN	S	<=0.5
CEFTAZIDIME	S	<=0.12
CEFTIOFUR	S	<=1
IMIPENEM	S	<=0.25
AMIKACIN	S	<=2
GENTAMICIN	S	<=1
CIPROFLOXACIN	S	<=0.06
ENROFLOXACIN	S	<=0.12
MARBOFLOXACIN	S	<=0.5
DOXYCYCLINE	S	1
NITROFURANTOIN	S	<=16
TRIMETHOPRIM/SULPHATE	S	<=20



Urine
Microscopy
White Blood Cells **> 100 /HPF**
Red Blood Cells **2-5 /HPF**
Bacteria **0 Marked Rods (>40 /HPF)**
Epithelial Cells
Crystals None Seen

Negative	Negative
Normal	Normal
Dis...	
> 100 /HPF	0-2 /HPF
2-5 /HPF	10-15 /HPF
Marked Ro...	None Seen
	1+ Transi...
None Seen	None Seen



URINALYSIS

TEST	RESULT	REF.RANGE/UNITS
Collection	CYSTOCENTESIS	
Colour	Yellow	
Clarity	Cloudy	
Specific Gravity	1.025	
pH	5.5	
Urine Protein	Negative	
Glucose	Negative	
Ketones	Negative	
Blood / Hemoglobin	Negative	
Bilirubin	Negative	
Urobilinogen	Normal	
White Blood Cells	30-50 /HPF	
Red Blood Cells	None Seen	
Bacteria ^a	Marked Rods (>40 /HPF)	
Epithelial Cells	1+ Transitional epithelial cells (1-2 /HPF)	
Crystals	None Seen	

No Clinical Signs at home



TEST: UCUL

Source: ^b

Site:

Status :

Culture Results:

Organism 1 :

CYSTOCENTESIS

CYSTO

FINAL

Escherichia coli - >1x10E5 CFU/ml



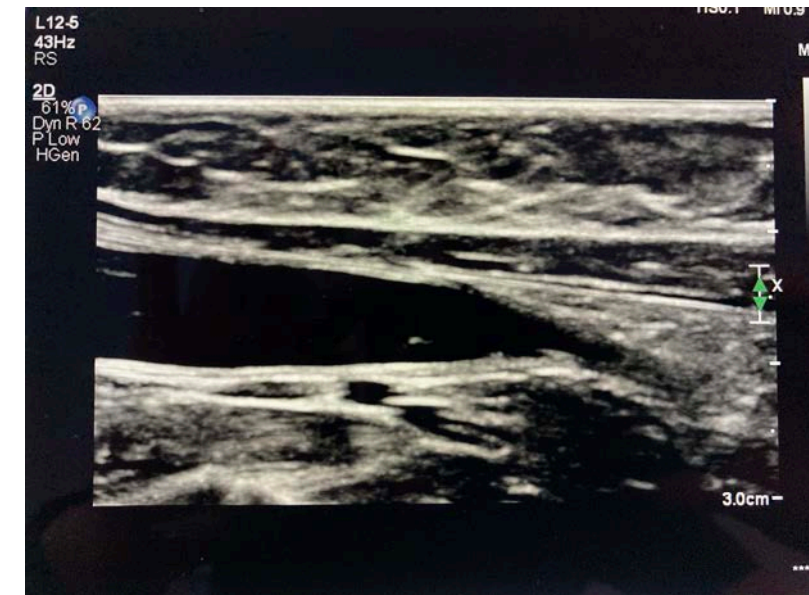
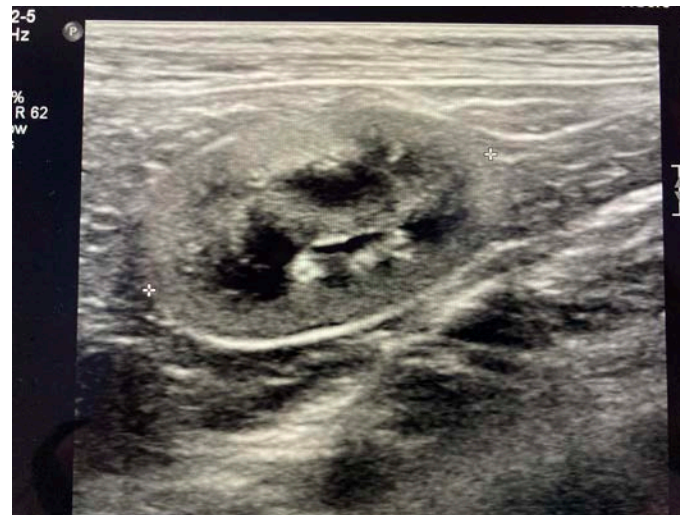
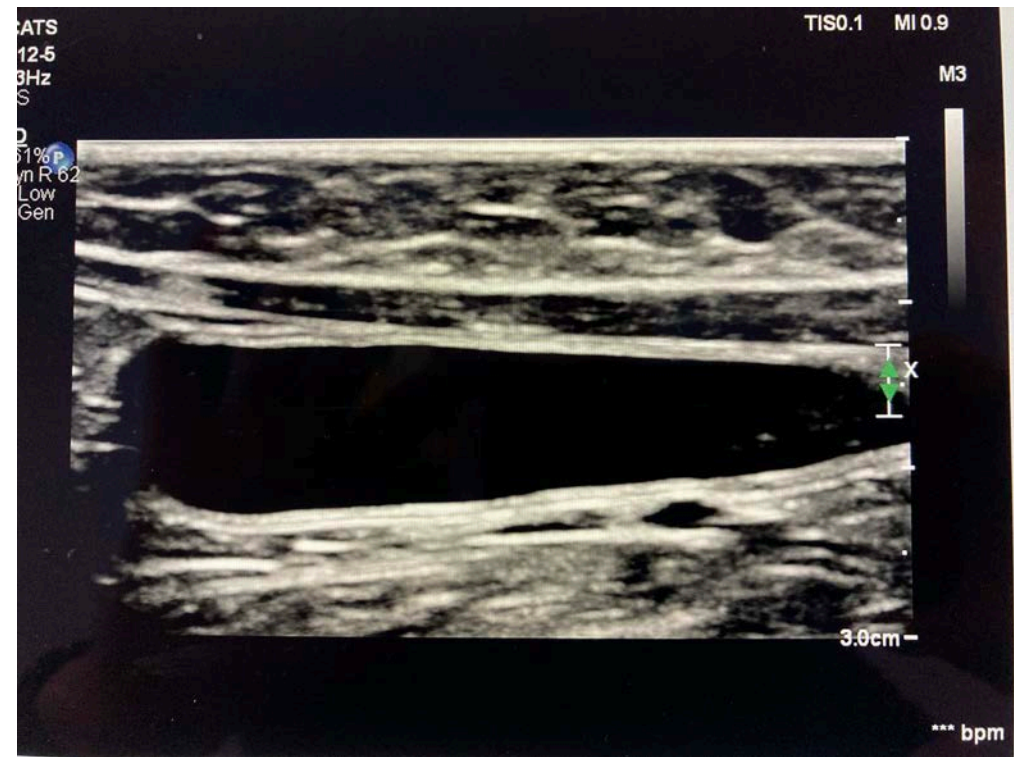
Antibiotic	Organism 1	
	Escherichia coli	
	Interp.	MIC µg/mL
Amoxicillin	S	4
Amoxicillin / Clavulanic Acid	S	<=2
Imipenem	S	<=0.25
Cephalexin	S	8

Antibiotic	Organism 1	
	Escherichia coli	
	Interp.	MIC µg/mL
Cefovecin	S	<=0.5
Cefpodoxime	S	<=0.25
Ceftazidime	S	<=0.12
Ceftiofur	S	<=1
Amikacin	S	<=2
Gentamicin	S	<=1
Ciprofloxacin	S	<=0.06
Enrofloxacin	S	<=0.12
Marbofloxacin	S	<=0.5
Doxycycline	S	1
Nitrofurantoin	S	<=16
Trimethoprim / Sulfa	S	<=20

S = Sensitive I = Intermediate R = Resistant
 TF = To Follow N/I = Not Indicated
 See NOTES section for more information.

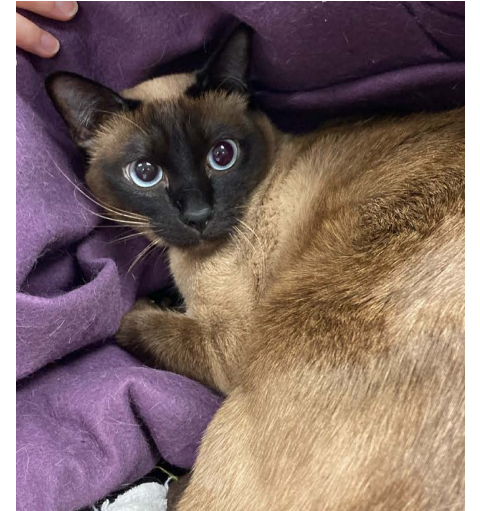
Abdominal Ultrasound

- Get images from SmartPACS
- Very mild chronic changes to the kidneys
- No ureteral changes
- Normal urinary bladder
 - No wall thickening
 - No debris in bladder
 - No uroliths
 - No mass



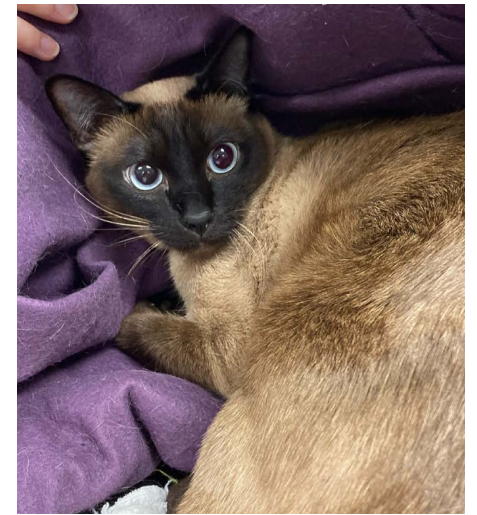
Key Features of Case

- Early stage CKD
 - Mild increases in SDMA and Creatinine, normal BUN
 - Poorly concentrated USG, but not isosthenuric
- Persistent bacteriuria
 - Pyuria
- Cat is asymptomatic!
 - Has only had true lower urinary tract signs 2 times
 - Episodes more consistent with FIC or FLUTD
 - Identifiable stressful causes
 - Quick resolution of clinical signs



Diagnosis?

- Subclinical bacteriuria
- Treatment recommendations
 - Do not treat with antimicrobials
 - Renal diet
 - Home management as for FIC cats
 - In the future?
 - If there are lower urinary tract signs, consider therapy
 - Also consider recurrent FIC



- Monitoring
 - Check chemistry panel and USG in 4-6 months
 - To monitor CKD
 - Should we check a UA?
 - Maybe for pH
 - What if there is pyuria/bacteriuria
 - Culture?
 - Only if you think you'd treat...

Case 2

Recurrent Bacterial Cystitis



Remember Predisposing causes/factors

- Anatomical factors
 - Ectopic ureters
 - Persistent vaginal membranes
 - Recessed/hooded vulvas
 - Prostate
 - Pelvic Bladder
- Neurological disease
 - Inability to empty bladder
 - USMI
- Inflammatory Disease
 - Polypoid cystitis
 - Proliferative urethritis
- Concurrent Disease
 - Urolithiasis
 - CKD
 - DM
 - HAC
 - General PU/PD
- Immunosuppression
 - Drugs
 - Chemotherapy

Zoey

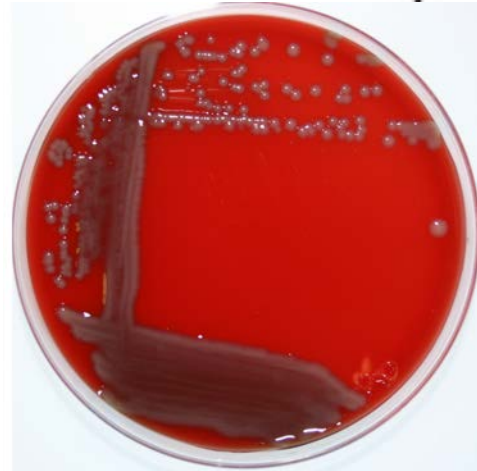
- 6-month-old female Labrador cross
- Referred for recurrent UTIs
 - Multiple courses of treatment
 - Never cleared or immediate return
- Incontinent since adoption
 - Puddles behind her after lying/sleeping



Lab Results

URINALYSIS

TEST	RESULT	REF. RANGE/UNITS
Collection	free catch	
Colour	Yellow	
Clarity	Cloudy	
Specific Gravity	1.024	
pH	6.5	
Urine Protein	Negative	
Glucose	Negative	
Ketones	Negative	
Blood / Hemoglobin	Negative	
Bilirubin	Negative	
Urobilinogen	Normal	
Urine Microscopy	Debris 1+ WBC clumps (1-2 /HPF)	
White Blood Cells	30-50 /HPF	
Red Blood Cells	None Seen	
Bacteria *	Marked Rods (>40 /HPF)	
Epithelial Cells	1+ Squamous epithelial cells (1-2 /HPF)	
Crystals	Triple phosphate (1-5 /HPF)	



MICROBIOLOGY

TEST: CUL

Source: ^b

FREECATCH

Status :

FINAL

Culture Results:

Organism 1 :

Klebsiella pneumoniae - >1x10E5 CFU/ml

Organism 2 :

Proteus mirabilis - 1-10x10E3CFU/ml

Antibiotic	Organism 1		Organism 2	
	<i>Klebsiella pneumoniae</i>		<i>Proteus mirabilis</i>	
	Interp.	MIC µg/mL	Interp.	MIC µg/mL
Amoxicillin	R	16	S	≤2
Amoxicillin / Clavulanic Acid	S	≤2	S	≤2
Imipenem	S	≤0.25	N/I	
Cephalexin	S	≤4	I	16
Cefovecin	S	≤0.5	S	≤0.5
Cefpodoxime	S	≤0.25	S	≤0.25
Ceftazidime	S	≤0.12	S	≤0.12
Ceftiofur	S	≤1	S	≤1
Amikacin	S	≤2	S	≤2
Gentamicin	S	≤1	S	≤1
Ciprofloxacin	S	≤0.06	S	≤0.06
Enrofloxacin	S	≤0.12	S	≤0.12
Marbofloxacin	S	≤0.5	S	≤0.5
Doxycycline	S	1	R	≥16
Nitrofurantoin	I	64	R	128
Trimethoprim / Sulfa	S	≤20	S	≤20

URINALYSIS

TEST	RESULT	REF.RANGE/UNITS
Collection	free catch	
Colour	Yellow	
Clarity	Clear	
Specific Gravity	1.028	
pH	6.0	
Urine Protein	Negative	
Glucose	Negative	
Ketones	Negative	
Blood / Hemoglobin	Negative	
Bilirubin	Negative	
Urobilinogen	Normal	
Urine Microscopy	1+ Epithelial clumps (1-2 /HPF) 1+ WBC clumps (1-2 /HPF)	
White Blood Cells	20-30 /HPF	
Red Blood Cells	None Seen	
Bacteria	None Seen	
Epithelial Cells	2+ Transitional epithelial cells (3-5 /HPF)	
Crystals	None Seen	

ORDER NOTES

UTI has been clavaseptin

URINALYSIS

TEST	RESULT	REF.RANGE/UNITS
Collection	FREE CATCH	
Colour	Yellow	
Clarity	Clear	
Specific Gravity	1.029	
pH	5.5	
Urine Protein	Negative	
Glucose	Negative	
Ketones	Negative	
Blood / Hemoglobin	Negative	
Bilirubin	Negative	
Urobilinogen	Normal	
Urine Microscopy	1+ WBC clumps (1-2 /HPF)	
White Blood Cells	6-10 /HPF	
Red Blood Cells	None Seen	
Bacteria	None Seen	
Epithelial Cells	1+ Squamous epithelial cells (1-2 /HPF)	
Crystals	None Seen	

PATHOLOGY

TEST: 1PATHA

Pathologist Interpretation

URINALYSIS:

USG adequate.

Pyuria, recommend culture.

Noted history of UTI and therapy

HEMATOLOGY

TEST	RESULT	REF. RANGE/UNITS
RBC	6.5	5.4 - 8.7 x10E12/L
Hematocrit	0.44	0.38 - 0.57 L/L
Hemoglobin	145	134 - 207 g/L
MCV	67.7	59.0 - 76.0 fL
MCH	22.3	21.9 - 26.1 pg
MCHC	329.5	326.0 - 392.0 g/L
RDW	15.5	10.0 - 19.0
% Reticulocyte	1.5	%
Reticulocytes	97.5	10.0 - 110.0 x10E3/uL
Reticulocyte Hemoglobin	27.2	24.5 - 31.8 pg
WBC	16.6	4.9 - 17.6 x10E9/L
% Neutrophils	44.9	%
% Lymphocytes	42.8	%
% Monocytes	5.6	%
% Eosinophils	6.5	%
% Basophils	0.2	%
Neutrophils	7.5	2.9 - 12.7 x10E9/L
H Lymphocytes	7.1	1.1 - 5.0 x10E9/L
Monocytes	0.9	0.0 - 1.2 x10E9/L
Eosinophils	1.1	0.0 - 1.5 x10E9/L
Basophils	0.0	0.0 - 0.1 x10E9/L
Platelets	300	143 - 448 x10E9/L
Platelet Comments	Platelet assessment Adequate Mild platelet clumping observed	

CBC Comment RBC, WBC, and platelet morphology normal

CHEMISTRY

TEST	RESULT	REF. RANGE/UNITS
Glucose	5.4	3.5 - 6.3 mmol/L
H IDEXX SDMA *	17	0 - 14 ug/dL
Creatinine	105	44 - 133 umol/L

Urea (BUN)	8.4	3.2 - 11.0 mmol/L
BUN: Creatinine Ratio	20	
H Phosphorus	2.5	0.8 - 2.0 mmol/L
Calcium	2.7	2.2 - 2.8 mmol/L
Sodium	146	142 - 152 mmol/L
Potassium	4.8	4.0 - 5.4 mmol/L
Na: K Ratio	30	28 - 37
Chloride	110	108 - 119 mmol/L
TCO2 (Bicarbonate)	24	13 - 27 mmol/L
Anion Gap	17	11 - 26 mmol/L
Total Cations	151	mmol/L
Total Anions	134	mmol/L
L Total Protein	54	55 - 75 g/L
Albumin	29	27 - 39 g/L
Globulin	25	24 - 40 g/L
Albumin: Globulin Ratio	1.2	0.7 - 1.5
ALT	24	18 - 121 IU/L
AST	19	16 - 55 IU/L
H ALP	171	5 - 160 IU/L
GGT	5	0 - 13 IU/L
Bilirubin - Total	1.2	0.0 - 5.2 umol/L
Cholesterol	7.2	3.4 - 8.9 mmol/L
Amylase	443	337 - 1469 IU/L
Lipase ^b	62	0 - 250 IU/L
H Creatine Kinase	269	10 - 200 IU/L
Osmolality	294	250 - 310 mmol/kg
Hemolysis Index	Normal	
Icterus Index	Normal	
Lipemia Index	Normal	

ENDOCRINOLOGY

TEST	RESULT	REF. RANGE/UNITS
Total T4 ^c	44.6	13.0 - 53.0 nmol/L

URINALYSIS

TEST	RESULT	REF.RANGE/UNITS
Collection	Free Catch	
Colour	Yellow	
Clarity	Cloudy	
Specific Gravity	1.022	
pH	6.0	
Urine Protein	Negative	
Glucose	Negative	
Ketones	Negative	
Blood / Hemoglobin	Negative	
Bilirubin	Negative	
Urobilinogen	Normal	
Urine Microscopy	1+ WBC clumps (1-2 /HPF)	
White Blood Cells	30-50 /HPF	
Red Blood Cells	None Seen	
Bacteria *	Marked Rods (>40 /HPF)	
Epithelial Cells	1+ Transitional epithelial cells (1-2 /HPF)	
Crystals	None Seen	

MICROBIOLOGY

TEST: UCUL

Source: ^b

Site:

Status :

Culture Results:

Organism 1 :

CYSTOCENTESIS

CYSTO

FINAL

Klebsiella pneumoniae - >1x10E5 CFU/ml

Antibiotic	Organism 1	
	Klebsiella pneumoniae	
	Interp.	MIC µg/mL
Amoxicillin	R	16
Amoxicillin / Clavulanic Acid	S	<=2
Imipenem	S	<=0.25
Cephalexin	S	<=4

Antibiotic	Organism 1	
	Klebsiella pneumoniae	
	Interp.	MIC µg/mL
Cefovecin	S	<=0.5
Cefpodoxime	S	<=0.25
Ceftazidime	S	<=0.12
Ceftiofur	S	<=1
Amikacin	S	<=2
Gentamicin	S	<=1
Ciprofloxacin	S	<=0.06
Enrofloxacin	S	<=0.12
Marbofloxacin	S	<=0.5
Doxycycline	S	1
Nitrofurantoin	S	32
Trimethoprim / Sulfa	S	<=20

Abdominal Ultrasound

- Right kidney has mild pelvic dilation (1.4cm)
- Right ureter moderately dilated throughout
- Urinary bladder normal in appearance
 - Individual ureteral papillae not clearly visualized
 - This is often the case

An ultrasound-guided cystocentesis was obtained, with no procedure-related complications.

Diagnostic Impressions: There is moderate dilation of the right renal pelvis as well as dilation of the entire visualized right ureter, which can be traced adjacent to the urinary bladder, highly suggestive of a right-sided ectopic ureter. Consultation with a surgeon for a scope and/or contrast CT and surgical intervention is highly recommended. The urinary bladder contains a moderate amount of echogenic material with some tiny sand-like debris, consistent with chronic infection.

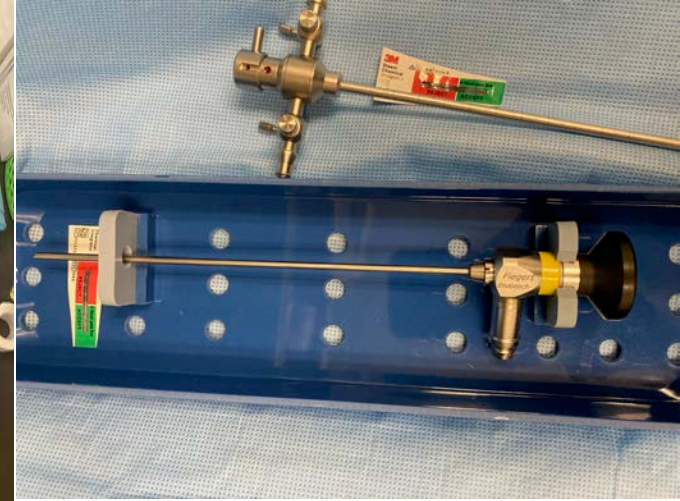
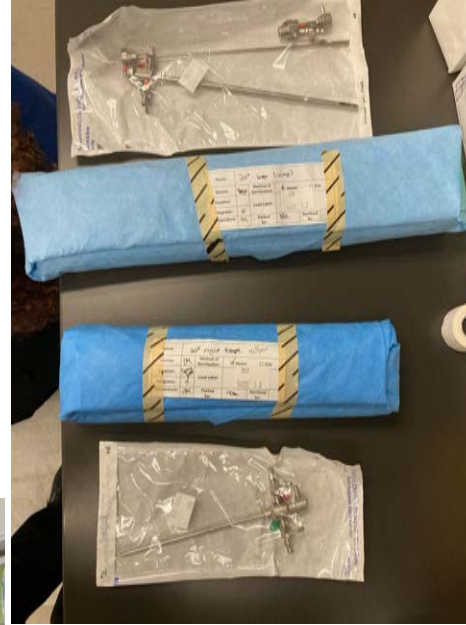
Janet A. Nieckarz-Loeven, DVM Dipl. ACVR

Physical Exam

- General exam normal
- Urinary/reproductive exam
 - Slightly recessed vulva
 - Urine leaking during exam
 - Wet fur
 - No significant erythema
- Rectal Exam
 - Normal soft urethra



Cystoscopy Equipment



Rigid Cystoscopy





Cystoscopy Positioning

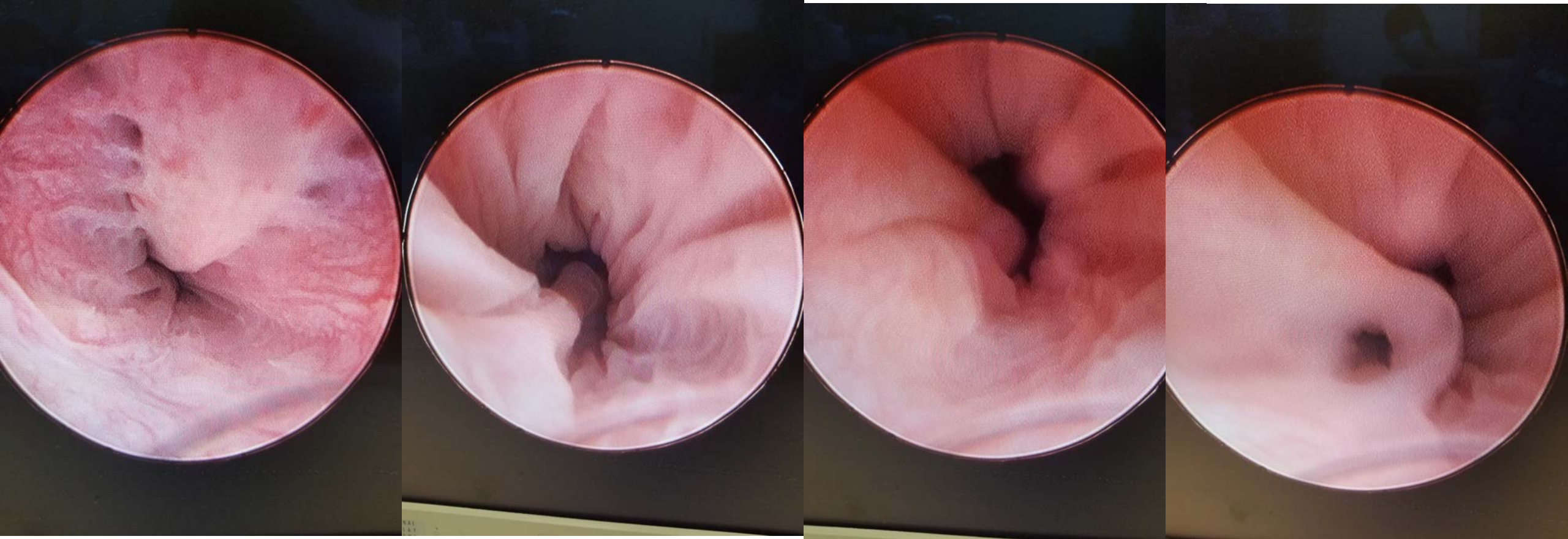
Cystoscopy - Vestibule



Lymphoid Follicles



Cystoscopy



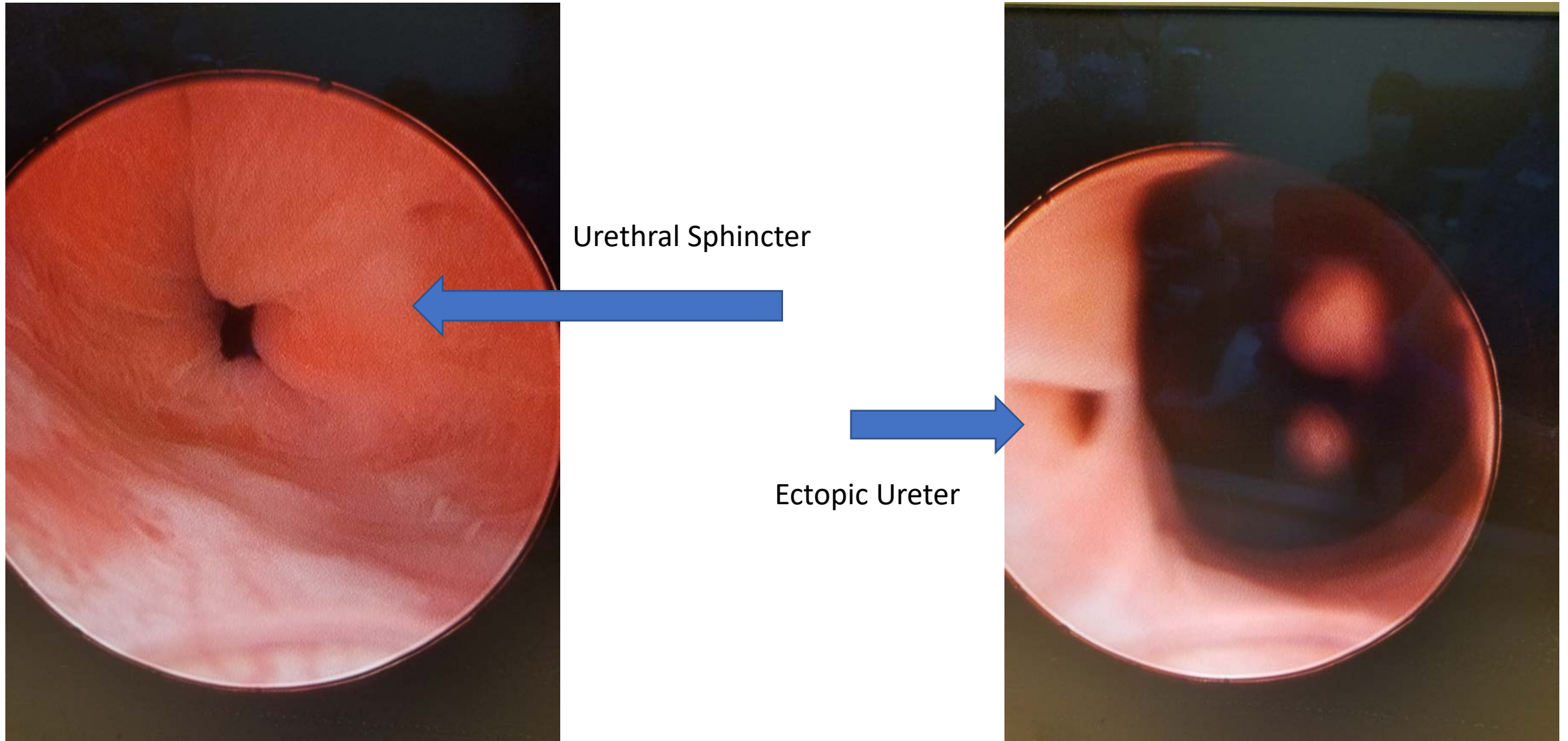
Urethral Papilla

Distal Urethra

Mid Urethra

Ectopic Ureter

Cystoscopy – Urethrovesicular Junction



Too many openings!



More typical appearance of ureteral papilla

Multiple ectopic R ureteral openings

What now?

- Surgery
 - Right ureter identified (quite dilated)
 - Ligated R ureter and reimplanted in bladder
 - Effectively cuts off all the other openings
- Recovered well
- 2 days post-op – still incontinent
 - Needs time to recover
 - Catheterized after surgery



- Next Steps
 - Allow for complete recovery first
- Urine culture pending
 - Antibiotic therapy for 7 more days
- If incontinence persists:
 - PPA or DES trial
 - Consider placement of hydraulic occluder

Ectopic Ureters

- Intramural (95%)
 - Open into the bladder tunnel to another location
- Extramural (5%)
 - Open into another site (urethra, vagina, uterus, vestibule)
- 32-91% are bilateral
- Signalment
 - 90% occur in young female dogs
 - Lots of predisposed breeds, but anyone can have them



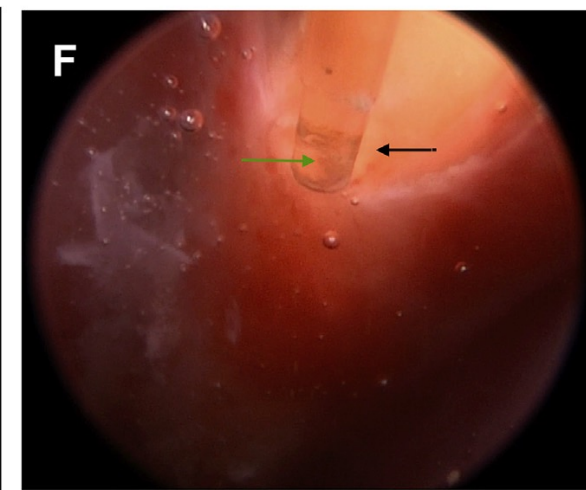
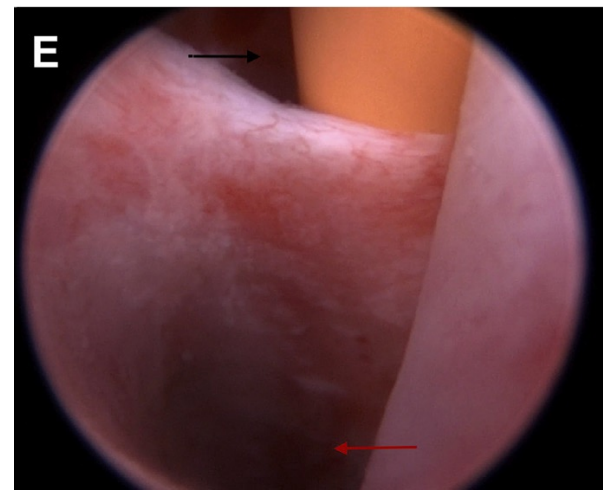
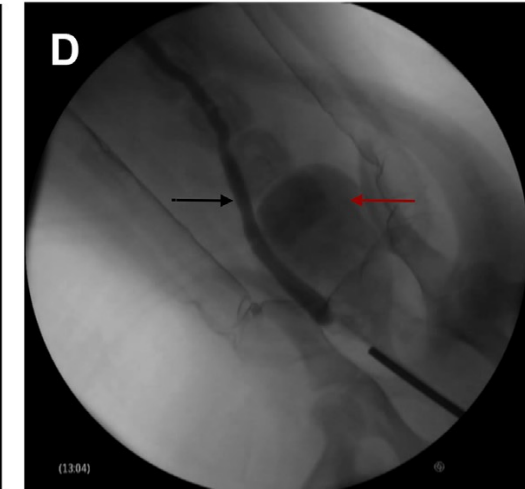
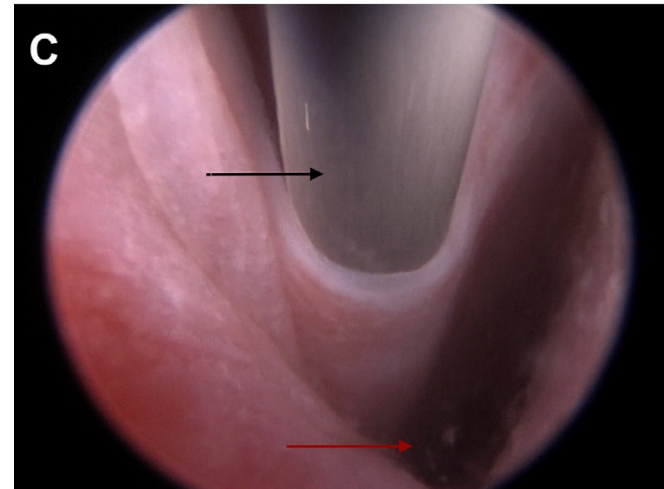
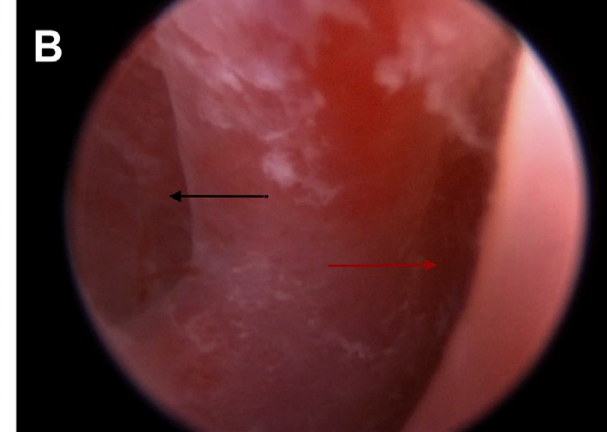
Ectopic Ureters

- Clinical signs
 - Urinary incontinence
 - Particularly when lying down/sleeping
 - Usually since birth
 - Recurrent urinary tract infections
 - Difficult to house train
- Treatment
 - Surgical reimplantation
 - Laser ablation

Canine Incontinence

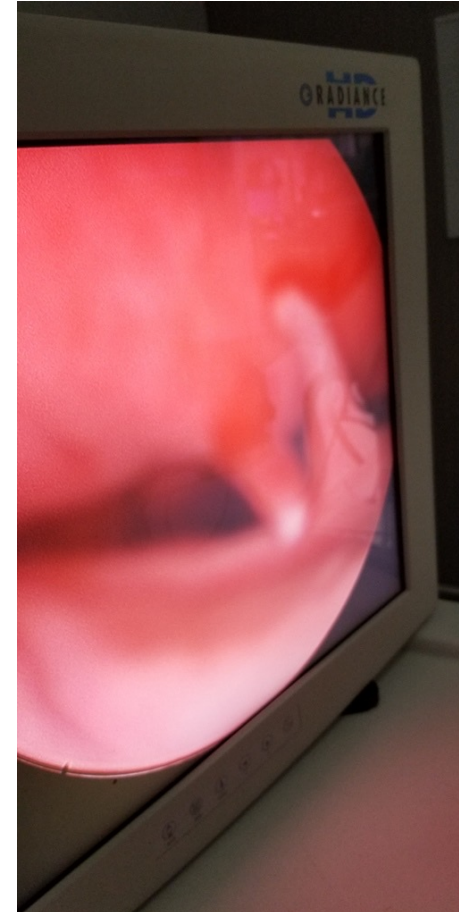
Vet Clin Small Anim 49 (2019) 125–140
<https://doi.org/10.1016/j.cvsm.2018.11.003>

Mark J. Acierno, MBA, DVM^a, Mary Anna Labato, DVM^{b,*}



Persistent Vaginal Membranes

- Several variations
- How do they cause disease
 - Allow for urine pooling resulting in irritation
 - Ascending bacterial infection
- Diagnosis
 - Digital vaginal exam
 - Cystoscopy
- Treatment
 - Break the band of tissue
 - Often can do with your finger



Recessed/Hooded Vulvas

Transurethral cystoscopy in dogs with recurrent urinary tract infections: Retrospective study (2011-2018)

Marie Llido¹ | Catherine Vachon¹ | Melanie Dickinson² | Guy Beauchamp¹ | Marilyn Dunn¹

- JVIM 2019
 - Observed a high prevalence of hooded vulva (69%)
 - Episioplasty was performed in only 21%
- Severely affected dogs more likely to be clinically relevant
 - Episioplasty reduces UTIs in 84% to 100% of dogs
 - Obesity can be a big factor in conformation
- How does this cause disease?
 - Urine pooling, perivulvar dermatitis, fecal contamination
 - Ascending bacterial infection

Recessed Vulvas

- Or does it?
- 14% of dogs, most common in spayed females and overweight dogs
- Did NOT find a higher rate of UTIs

Characterization of recessed vulvas in dogs

OBJECTIVE

To determine the prevalence of vulvar recession in a large population of dogs and to compare the reproductive and physical differences between dogs with and without recessed vulvas.

ANIMALS

250 female dogs presenting to a tertiary referral institution.

PROCEDURES

Female dogs > 6 months of age presenting to a tertiary referral institution were enrolled. At enrollment, a full medical history was obtained with particular emphasis on the presence of lower urinary tract (LUT) disease in the 3 months prior to presentation. All dogs underwent a full physical examination including perivulvar cytologic examination and scoring of the degree of perivulvar skin coverage on the basis of an 8-point scale. Dogs with scores of ≥ 7 were classified as having recessed vulvas. When available, urinalysis data were also included.

RESULTS

Recessed vulvas were identified in 36 of 250 (14%) dogs. Dogs with recessed vulvas had significantly higher body condition scores and body weights than unaffected dogs. In addition, recessed vulvas were more common in spayed than sexually intact dogs. Dogs spayed at ≤ 1 year of age were almost 3 times as likely to have vulvar recession, compared with dogs spayed at > 1 year of age. No significant difference was identified between affected and unaffected dogs with respect to the prevalence of LUT signs, urinary tract infections, or perivulvar dermatitis.

CONCLUSIONS AND CLINICAL RELEVANCE

Although recessed vulvas were relatively common in dogs, they did not appear to be associated with an increased risk of LUT disease or perivulvar dermatitis. (*J Am Vet Med Assoc* 2021;259:744–748)

Recessed or Hooded Vulvas

- Bottom line
 - I do think this is a factor in some patients with recurrent UTIs
 - UTIs that we cannot solve by other means
 - Full investigation for other underlying causes
 - PU/PD disorders
 - Endocrinopathies
 - Dermatological disease
 - Obesity
 - Weight loss prior to procedure important
 - Need to know what your doing!
 - May need to be repeated?



The Prostate Gland

- What diseases?
 - Prostatitis/prostatic abscess
 - Intact male dogs
 - Prostatic neoplasia
 - Neutered male dogs
 - Benign prostatic hypertrophy
 - Neutered male dogs
- Clinical Signs
 - Febrile
 - Rectal exam:
 - Large prostate
 - Painful
 - Variable texture
- Laboratory Changes
 - Inflammatory CBC
- Sampling
 - Ultrasound guided FNA
 - Cytology and culture
 - Risks?
 - Prostatic washing
 - Ejaculate
 - Intact male dogs

Prostatitis

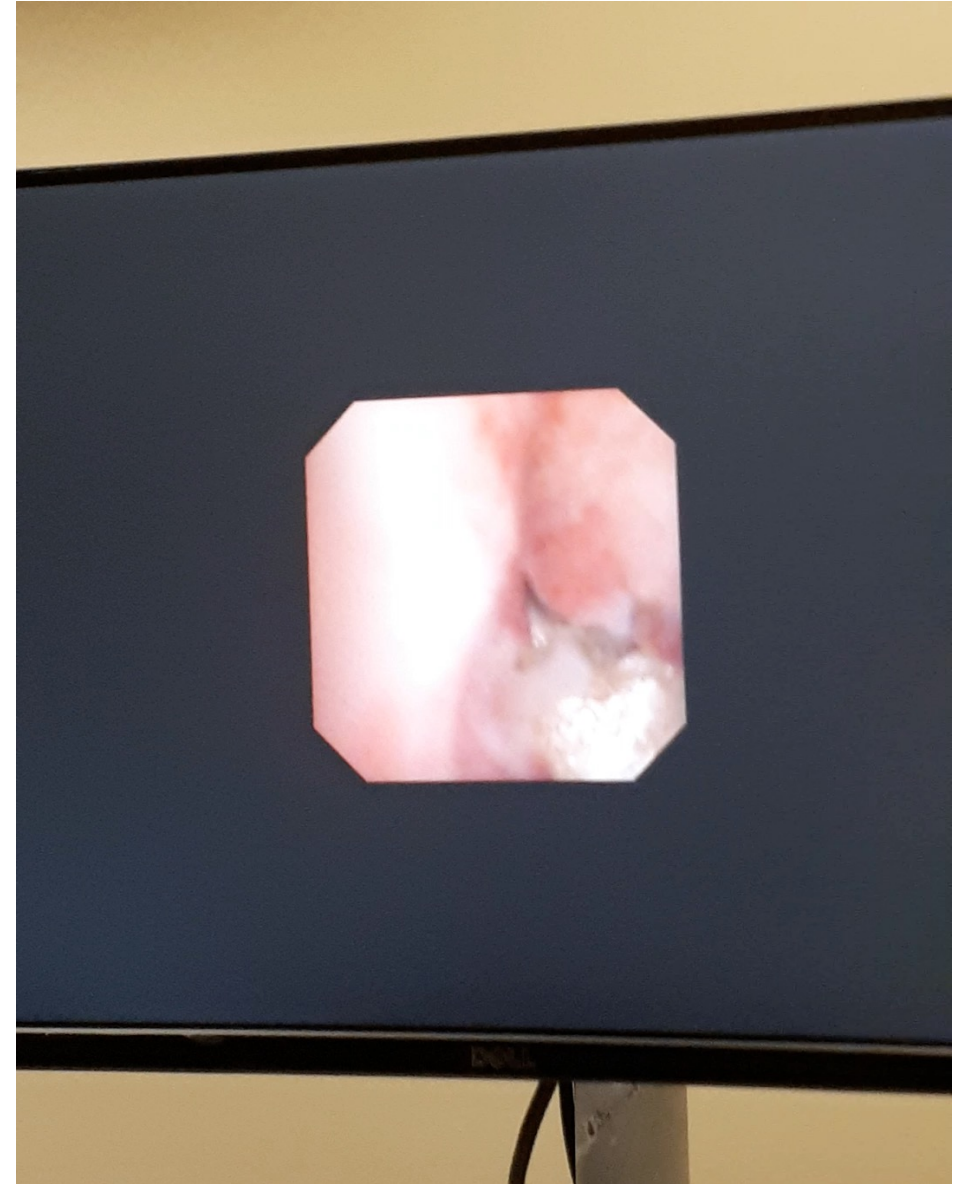
- How to treat?
 - Consider the target tissue
 - Blood/prostate barrier
 - Abscess
 - Surgical debridement and omentalization
- When to neuter?
 - AFTER treatment is complete and successful
 - Otherwise, decreased prostatic blood flow will limit deliver of antibiotics

Urolithiasis

- Types
 - Struvite
 - Calcium oxalate
 - Urate
 - Cysteine
 - Mixed
- Analysis
 - ALWAYS analyze a stone
 - Even if they have had them before!!
 - Culture the stone
 - Culture bladder wall
- An entire topic to itself!
 - Characteristics of each type
 - Medical vs surgical management
 - Males vs females
 - Diet
 - Dissolution vs maintenance
 - Underlying diseases
 - Hypercalcemia
 - Hyperadrenocorticism
 - Predisposed breeds

Cysteine Urolith

- Young adult (3 or 4 years old) Intact male Rottweiler
- Presenting Complaint:
 - Stranguria, hematuria of 1 month duration
 - Licking at penis
 - Lethargy, decreased appetite
- Physical exam
 - Bloody urine dripping from penis
 - Large, firm bladder on abdominal palpation
- Abdominal radiographs
 - Very large bladder
 - No visible uroliths



Urinary Incontinence

- Urethral Sphincter Mechanism Incontinence (USMI)
 - 3-20% of female dogs
 - Post spay (usually 3-4 years later)
 - Loss of estrogen decreases responsiveness to sympathetic stimulation, resulting in decreased tone
 - More than just this though!
 - GnRH and LH play a role in feedback and loss of smooth muscle contraction
 - Increased collagen in spayed females
 - Should we spay later?
 - Some studies say yes, but methodology issues make it hard to know
 - A more recent study suggests that dogs >25kg may benefit from later spay
 - Not true of small dogs
 - Congenital - often present in dogs with ectopic ureters

USMI and UTIs

- How does USMI influence UTIs?
 - Chronic periurethral/perivulvar dermatitis
 - Ascending infection of normal skin organisms
 - Recurrent infections
 - Sometimes different bacteria or mixed infections
 - Repeated therapy can lead to antimicrobial resistance

USMI Diagnosis

- Rule out other causes of incontinence
 - Ectopic ureters
 - Urolithiasis
 - Bladder/urethral masses
 - Pelvic bladder positioning
 - PU/PD disorders
 - Older patients often develop mild USMI
 - If they become PU/PD, their bladder is always full, stressing the sphincter tone
 - Fix the PU/PD and we sometimes fix the incontinence
 - Neurological disease
 - Pudendal nerve damage results in decreased sphincter tone
 - Sacral nerve damage results in lack of sensation to urinate leading to overflow

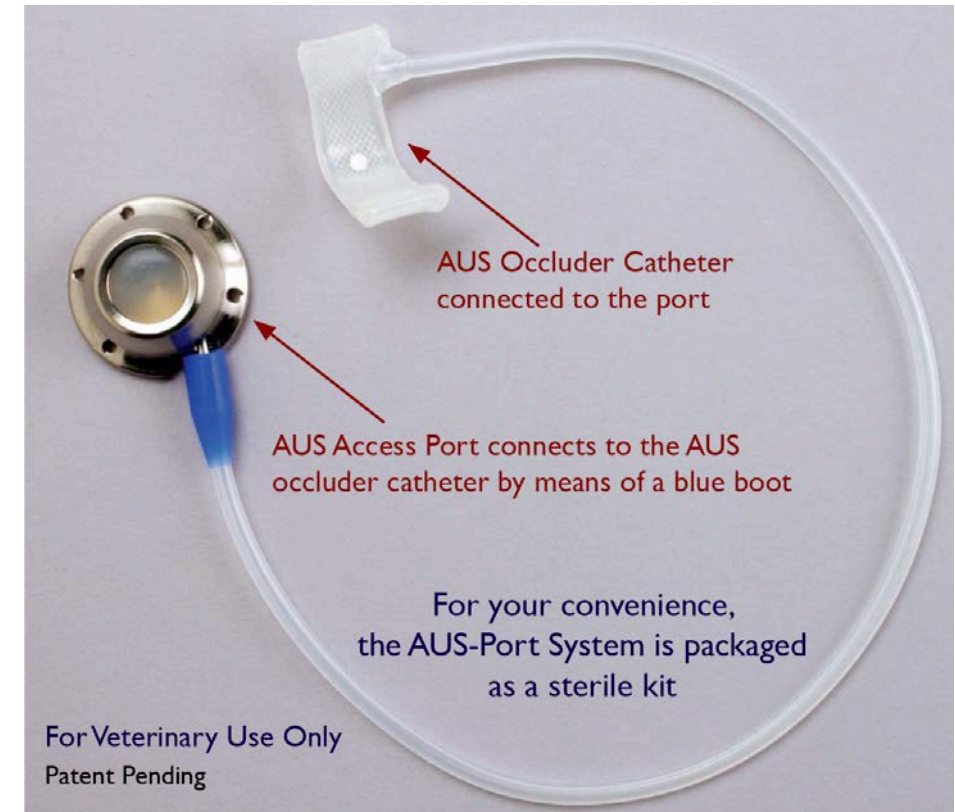
USMI Treatment

- Pharmacological Therapy
 - Phenylpropenalamine (PPA)
 - Multiple times per day (2-3)
 - Diethylstilbesterol
 - Daily for 5 days, then 1-2 times weekly
- Physical Intervention
 - Collagen injections
 - Good short term effect, likely need to be repeated
 - Hydraulic Occluder
 - Artificial urethral sphincter
 - I have had good success with my patients



USMI in Male Dogs

- Less frequent than in female dogs
- Medical Treatment less rewarding
 - Only 44% of male dogs respond to PPA
 - Only 38% respond to testosterone to become continent
 - 50% no response at all
 - Side effects: aggression and prostatomegaly
- My treatment recommendation:
 - Surgical placement of hydraulic occluder



Pelvic Bladder

- Some dogs with urinary incontinence have a bladder that is caudally located in the pelvis
- Unclear exactly why or how this related to incontinence
 - At least 50% of dogs with pelvic bladder are completely continent
- Often have a misshapen bladder
 - Fails to taper into the urethra
- Part of a bigger syndrome?
 - Shortened urethra
 - Dysfunctional detrusor muscle
 - Urethra that overrides the bladder?



PU/PD Disorders and UTIs

- Why does PU/PD lead to UTIs?
 - Dilute urine?
 - Lack of evidence that this and the resulting decreased osmolality predisposes to UTI
 - Glucosuria
 - Decreased neutrophil chemotaxis
 - Enhanced bacterial growth
 - Hypercalcemia
 - Increased mineral content and stone formation
- Clinical signs
 - Polyuria can hide pollakiuria
 - Dilute urine can make identification of hematuria and pyuria challenging

Diabetes Mellitus

- Most common reason for a well controlled diabetic to become poorly controlled
 - Major cause of DKA in dogs and cats
- Why do they get UTIs?
 - Enhanced bacterial growth due to the glucosuria
 - Dilute urine – lower urine osmolality
 - Decreased neutrophil chemotaxis – less pyuria
 - Due to glucosuria
 - Hard for owners to identify clinical signs – PU/PD

Retrospective Evaluation of Urinary Tract Infection in 42 Dogs with Hyperadrenocorticism or Diabetes Mellitus or Both

S. Dru Forrester, Gregory C. Troy, M. Nell Dalton, Jennifer W. Huffman, and Golde Holtzman

- 42/101 dogs 41.6% had positive cultures
 - 21/46 (46%) with HAC
 - 18/49 (37%) with DM
 - 3/6 (50%) with both

Table 1. Clinical signs in 101 dogs with hyperadrenocorticism or diabetes mellitus or both and results of quantitative urine cultures.

	Positive Culture (n = 42)	Negative Culture (n = 59)	P Value	Power
Polyuria/polydipsia	28 (67%)	45 (76%)	0.37	0.17
Stranguria	2 (4.76%)	0 (0%)	0.17	0.33
Pollakiuria	2 (4.76%)	1 (1.7%)	0.57	0.14
Discolored urine	2 (4.76%)	1 (1.7%)	0.57	0.14

Table 2. Urinalysis findings in 101 dogs with hyperadrenocorticism or diabetes mellitus or both and results of quantitative urine cultures.

	Positive Culture (n = 42)	Negative Culture (n = 59)	P Value
Specific gravity ^a	1.020 ± 0.013	1.022 ± 0.014	0.60
pH	6.13 ± 0.90	6.28 ± 0.98	0.52
Proteinuria	24 (57%)	38 (64%)	0.54
Occult blood	24 (57%)	20 (34%)	0.03
Hematuria	21 (50%)	20 (34%)	0.15
Pyuria	25 (60%)	9 (15%)	0.001
Bacteriuria	29 (69%)	4 (7%)	0.001

Immunosuppressed Conditions

- Primary
 - Impaired neutrophil chemotaxis may allow for bacterial colonization
 - Neutropenia
 - Inability to fight infection
- Secondary
 - Immunosuppressive therapy for a primary immune-mediated disease
 - Some evidence it may increase the risk of subclinical bacteriuria as opposed to true UTI
 - Do steroids or excess cortisol limit the ability of the body to express cystitis?
 - Chemotherapy
 - Is the patient suddenly ill?
 - Cyclophosphamide

Urinary Neoplasia

- Types
 - TCC/urothelial carcinoma (UC)
 - Prostatic carcinoma
 - Leiomyoma
- Locations
 - Bladder
 - TCC/UC often in the neck or trigone region (>50%)
 - Urethra
 - Prostate
 - Vaginal




Urinary Neoplasia: Diagnostic Testing

- Abdominal Ultrasound
- Traumatic Catheterization
- Cystoscopy + biopsy
- BRAF testing

ANTECH Test Guide ▾ Lab Diagnostics ▾ Sound Imaging Medical Support Education About ▾ Antech Online

CADET® BRAF and CADET® BRAF-PLUS

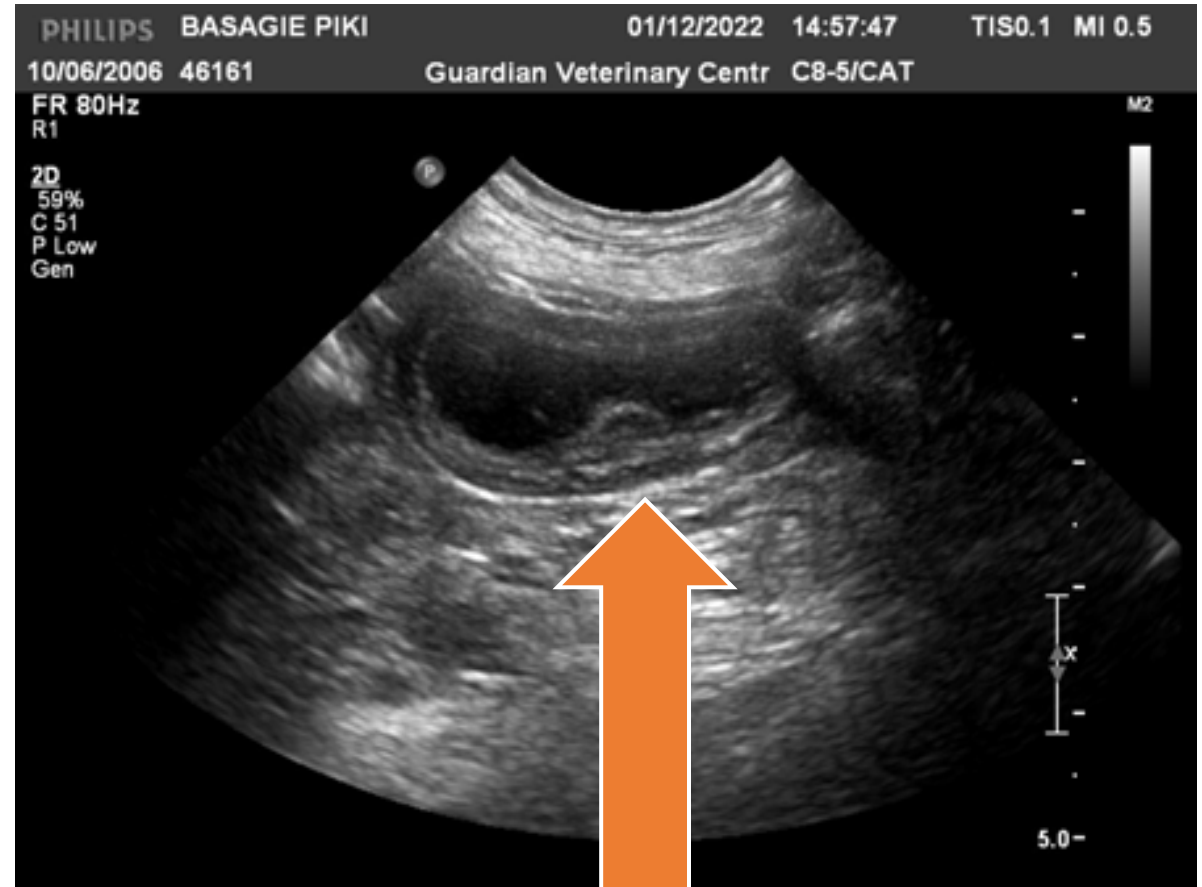
Accurate canine bladder and prostate cancer test.



The power of molecular diagnostics

CADET® BRAF evaluates urine samples from dogs for the presence of cells containing a mutation for canine bladder/prostate cancer (TCC/UC). It's cutting-edge technology that is accurate, affordable, and convenient for both veterinarian and pet owner.

[Download the Test Request Form](#)



Abdominal Ultrasound

- Excellent tool to identify masses with the bladder itself
 - Apex vs trigone
- Allows assessment of complicating factors
 - Ureteral obstruction and/or dilation
 - Regional lymph nodes
 - Prostate in male dogs
- Sampling?
 - FNA can seed the abdomen/body wall resulting in spread and rapid progression of disease
 - Guide catheter for traumatic catheterization



Traumatic Catheterization

- Materials:
 - Rigid polypropylene catheters
- Purpose:
 - Dislodge or break off small pieces of a mass lesion within the bladder/urethra
 - Differentiate between neoplastic and inflammatory disease
- Utility:
 - Easily performed under sedation
 - Often collects diagnostic samples
 - But not always
 - Can be guided by ultrasound or via rectal exam

Liquid Biopsy – CADET[®] BRAF testing

- There is a single mutation in exon 15 of the BRAF gene results in a change of an amino acid (valine to glutamic acid)
- 85% sensitivity and 99% specificity
 - 15% of TCC/UC do not have the BRAF mutation
 - 2/3 of these can be detected with BRAF Plus
 - False positive results have not been identified to date
- Sample:
 - 10mL of FREE CATCH sample
 - Specific collection container
 - CANNOT be refrigerated

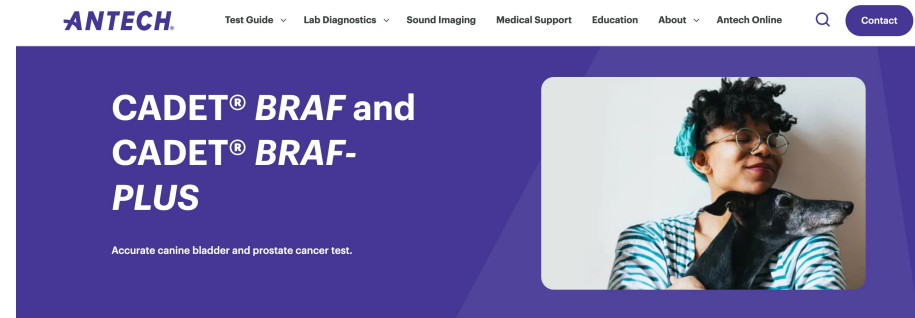
CADET BRAF and BRAF-Plus

Achieve accurate and early diagnosis of TCC/UC

CADET® *BRAF* is a highly sensitive test designed to monitor the b-raf mutation in TCC/UC cases during the course of their treatment, for therapeutic response and relapse. CADET® *BRAF* testing can be used for both the rapid, non-invasive assessment of dogs displaying clinical signs consistent with TCC/UC and for confirmed cases undergoing treatment.

How CADET® *BRAF* is used in a clinical setting


CADET® *BRAF* evaluates free-catch urine samples from dogs for the presence of cells harboring the BRAF mutation or specific copy number variations associated with TCC/UC. The assays identify 95% of TCC/UC cases. The extremely low limit of detection of 10 mutation-bearing cells in a urine sample allows early diagnosis of a developing TCC/UC, often several months before any advanced clinical signs associated with the cancer become evident.



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CADET® *BRAF* and CADET® *BRAF-PLUS*

Accurate canine bladder and prostate cancer test.



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Clinical indications for when to use CADET® BRAF and BRAF-PLUS

- **Clinical cases presenting with hematuria, stranguria, and/or urinary incontinence with diagnostic imaging evidence of a mass in the bladder.**
- **Confirmation of the TCC/UC diagnosis of a bladder mass from a stained cytology slide following ultrasonography and cytological examination of a fine-needle aspirate from tumor-bearing cells.**
- **Early diagnosis in clinical cases with recurrent, complicated, or antibiotic-resistant urinary tract infections presenting with hematuria without ultrasonographic evidence of a bladder mass.**

Urinary Neoplasia: Treatment

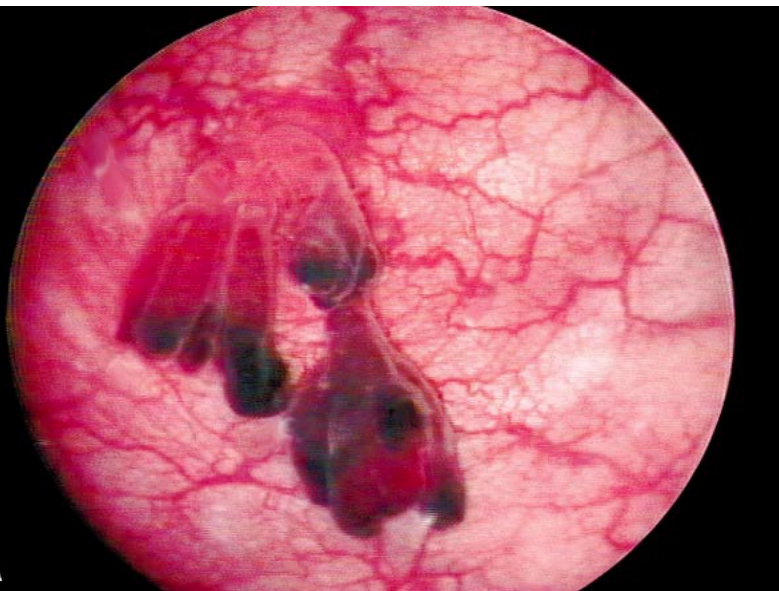
- Treatment of concurrent infection
 - Ideal drug?
 - Duration?
- Treatment of primary neoplasm
 - NSAIDs (piroxicam)
 - Chemotherapy
 - Radiation therapy
- Surgical excision
 - Maybe for TCC in the apex
 - Vaginal masses

Polypoid Cystitis

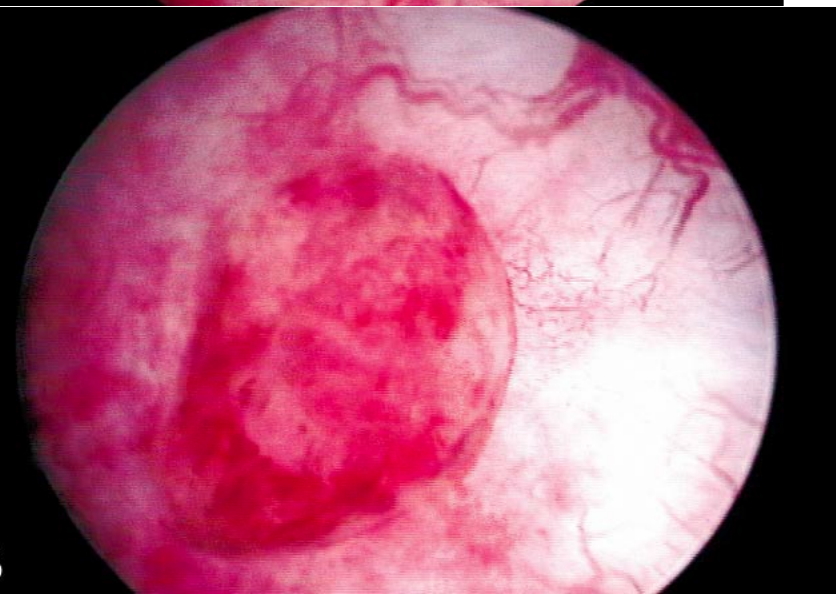
- Non-neoplastic inflammatory condition
 - From one to many mass like lesions
 - Hyperplastic transitional cells and variable amounts of inflammation
- Lesions may be ulcerated, hemorrhagic, hard to diff. from TCC
 - Often more cranioventral as opposed to TCC (neck/trigone)
- Cytologically can be similar to TCC
 - Nuclear criteria for malignancy should not be common, but...
 - Biopsy and histopathology needed to confirm diagnosis
 - Full thickness Sx biopsies consistently better than endoscopic bx

Polypoid Cystitis

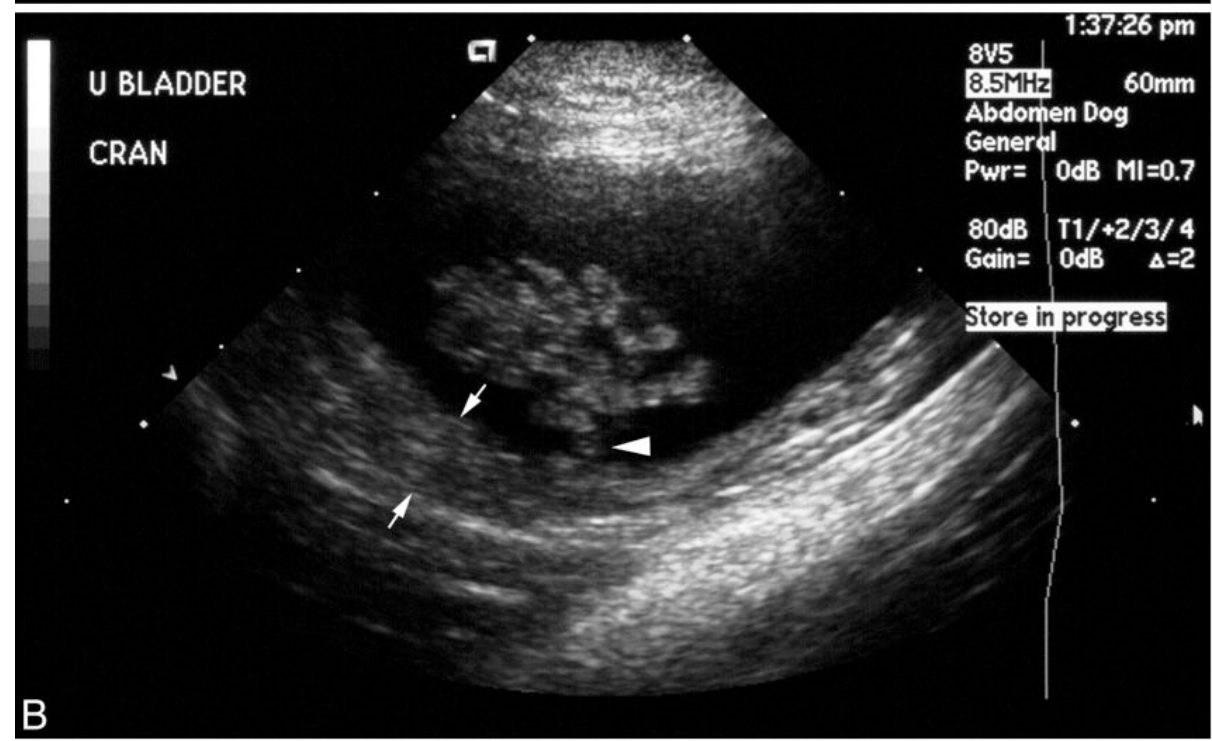
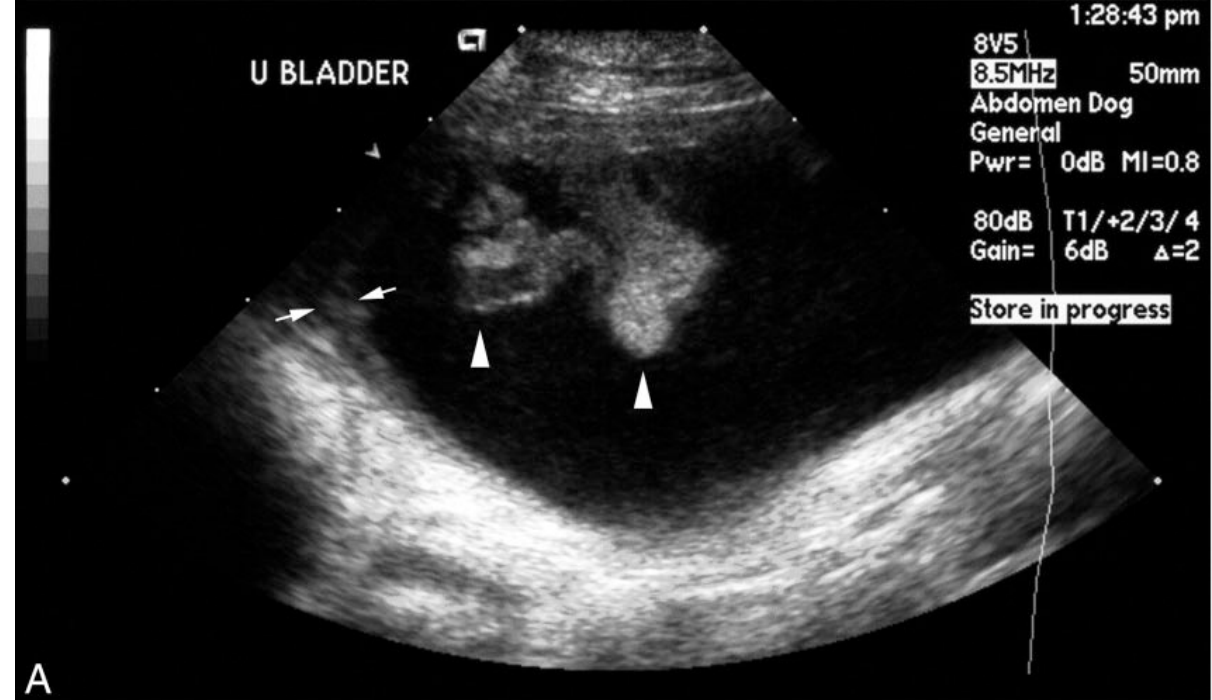
Polypoid Cystitis
in 17 Dogs (1978–
2001)
J Vet Intern Med
2003;17:499–509



A



B



Polypoid Cystitis

- Why does this happen?
 - No definitive answer
 - Chronic inflammation the most likely answer
 - Signs range from 2 weeks to 3 years before diagnosis in some dogs
 - People – chronic catheterization
- Clinical Signs:
 - Hematuria
 - Often without UTI
 - Persistent or Recurrent UTIs
 - Some dogs asymptomatic (esp males)
 - Females >> males (88% vs 12%)

Polypoid Cystitis

- What to do about it?
 - Treat concurrent UTI
 - This is a situation where longer duration therapy becomes appropriate
 - Abnormal mucosa makes it harder to clear infection
 - Culture bladder wall
 - Some studies find up to 18% of dogs with negative urine culture can have + mucosal culture
 - Manage concurrent urolithiasis
 - Surgery to excise the affected tissue is the best solution
 - Over ½ of dogs were normal after surgery
 - Some dogs have recurrent signs and need multiple surgeries
 - More common if the polyp debulked rather than partial cystectomy

Proliferative Urethritis

- Inflammatory, infiltrative disease of the urethra
 - Typically lymphoplasmacytic in nature
 - Causes partial or complete urethral obstruction
 - Previously called granulomatous urethritis
- Unknown cause
 - 73% of dogs have a history of UTIs
 - >50% of patients have + FisH for adhesive/invasive bacteria
 - Possibly immune-mediated reaction to infection
- Female dogs only

Proliferative Urethritis



Received: 16 June 2020 | Accepted: 2 December 2020

DOI: 10.1111/jvim.16007

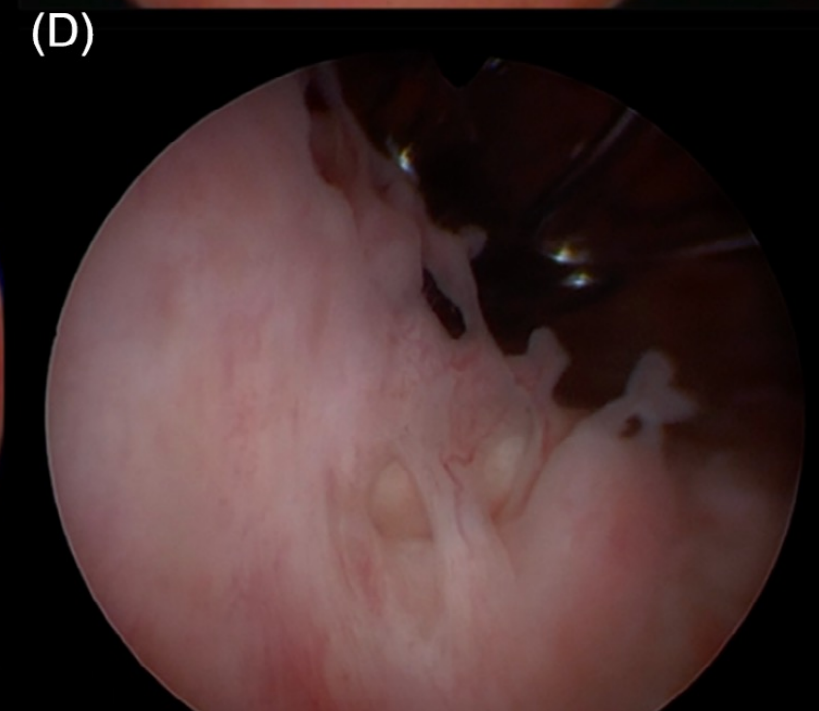
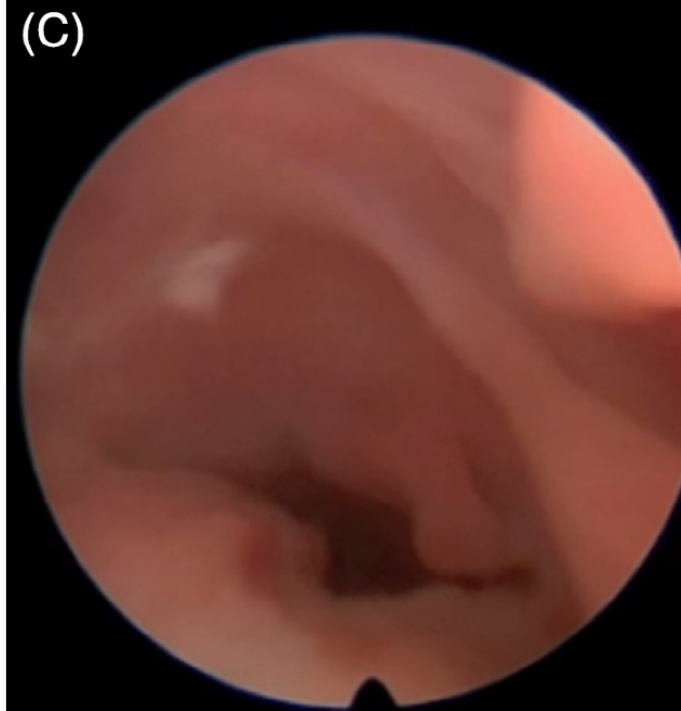
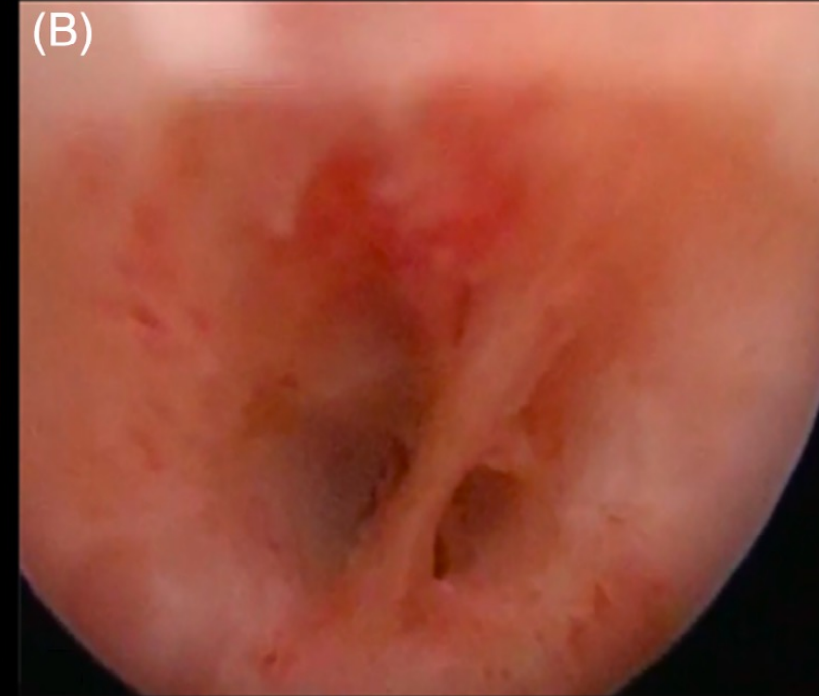
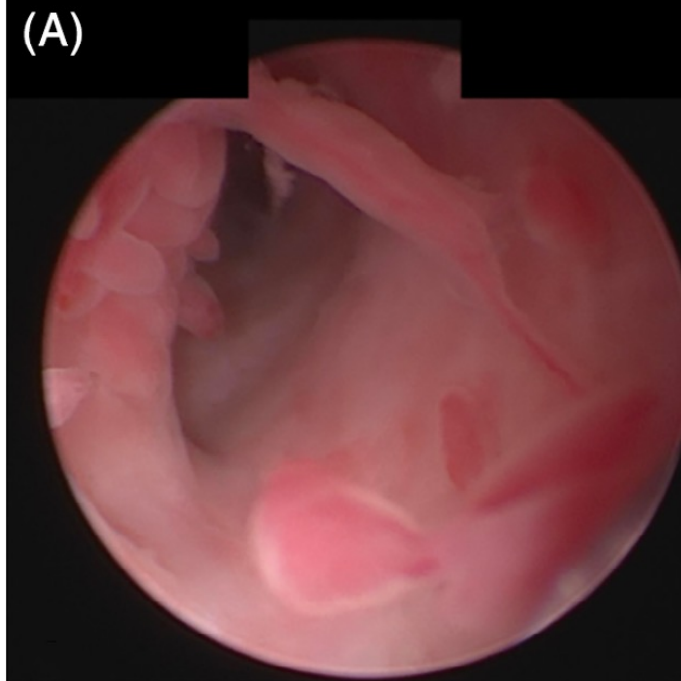
STANDARD ARTICLE

Journal of Veterinary Internal Medicine **ACVIM**
American College of Veterinary Internal Medicine

Retrospective study of proliferative urethritis in dogs: Clinical presentation and outcome using various treatment modalities in 11 dogs

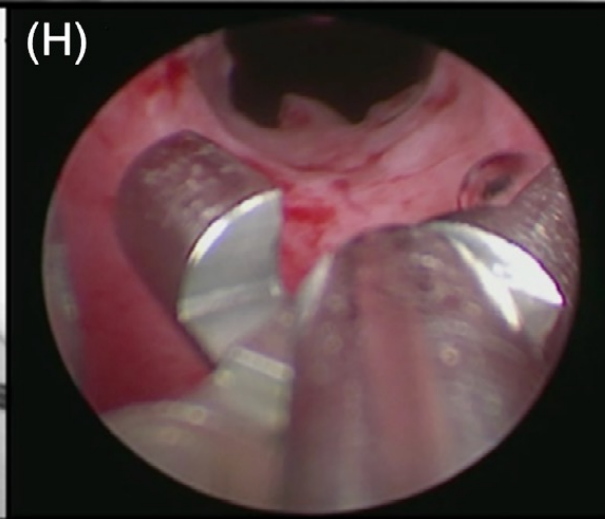
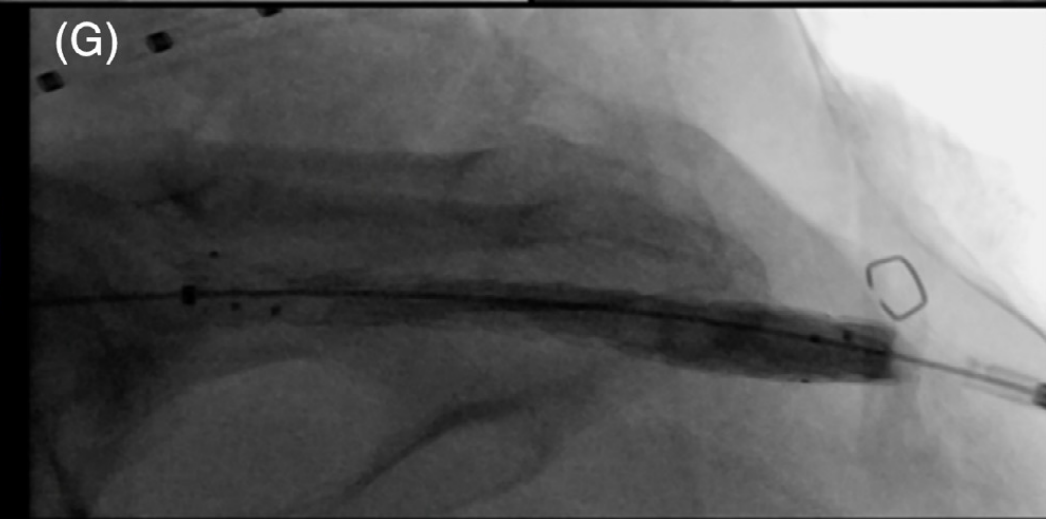
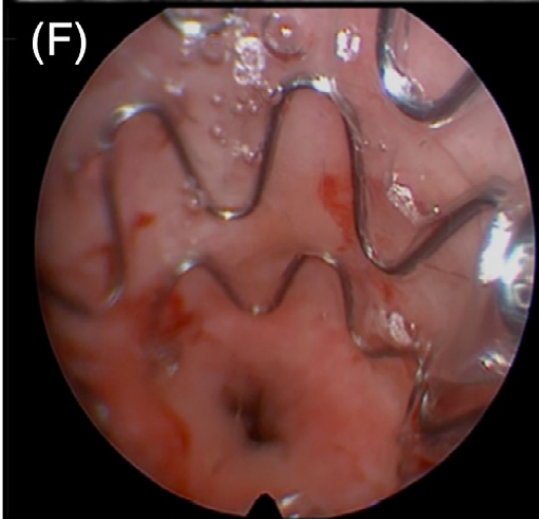
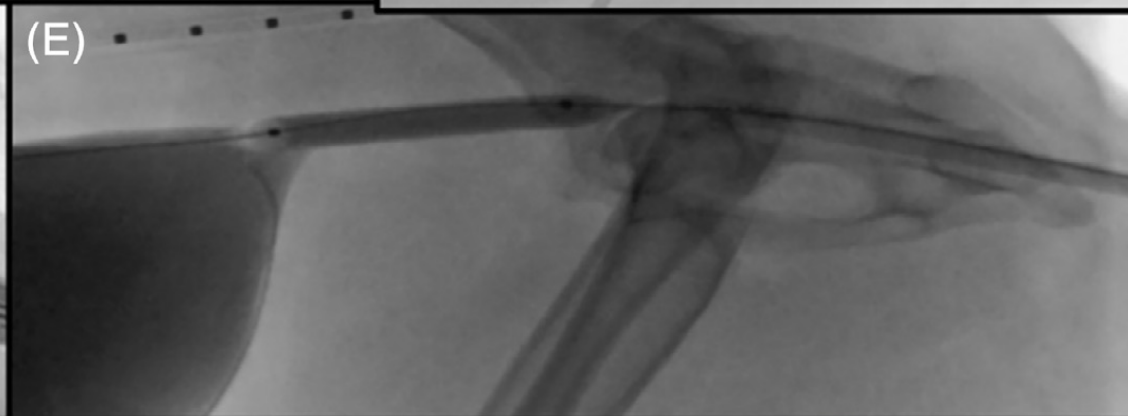
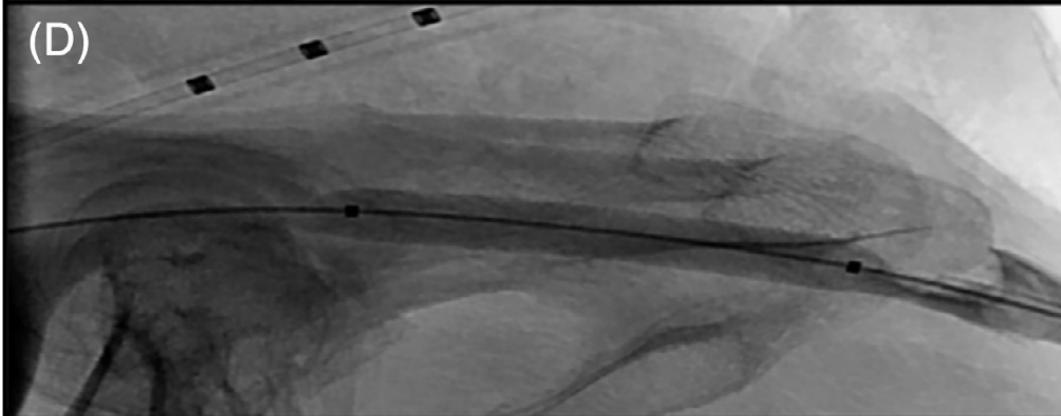
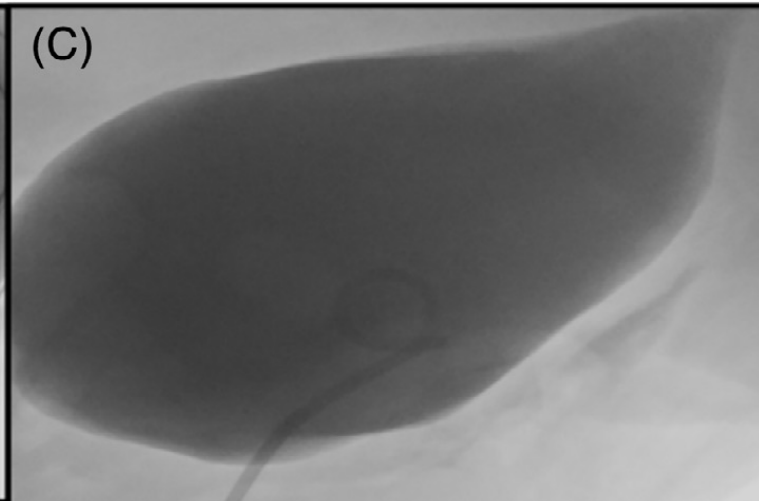
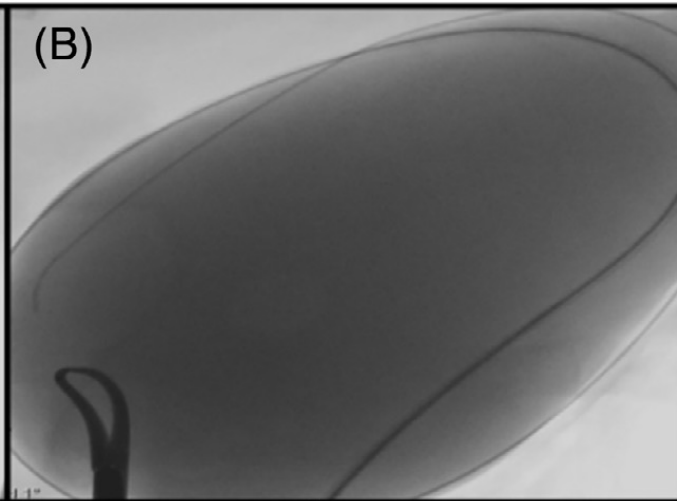
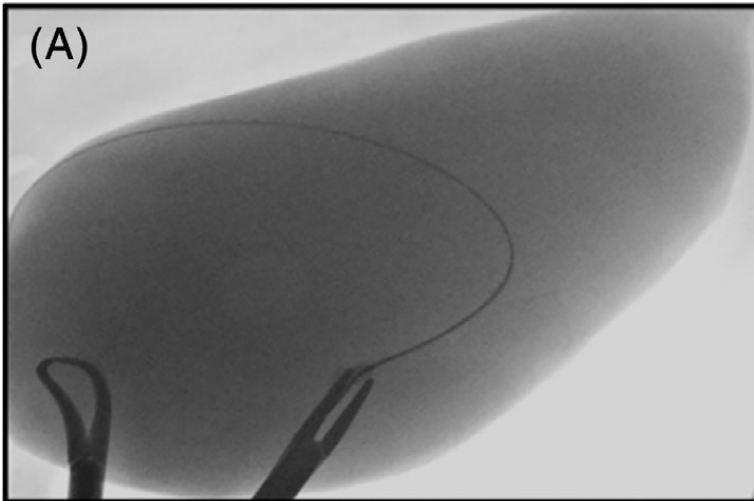
Max Emanuel  | Allyson C. Berent | Chick Weisse  | Taryn Donovan | Kenneth E. Lamb

Department of Interventional Radiology, Animal Medical Center, New York, New York




Proliferative Urethritis

- Treatment
 - Balloon dilation and/or placement of urethral stent
 - Without this, recurrent obstruction in ~3months
 - Median remission time 687 days (range 196-1738d) and Stent placement does seem to offer better outcome
 - Complications: 67% incontinent after stent placement
 - Immunosuppressive therapy
 - Azathioprine, often in combination with other drug (i.e. pred)



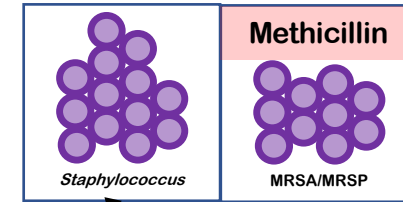
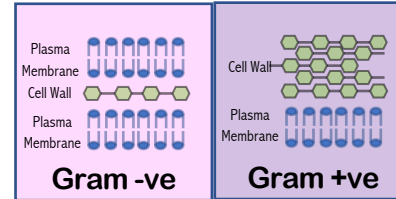
More About Drugs

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Tetracyclines

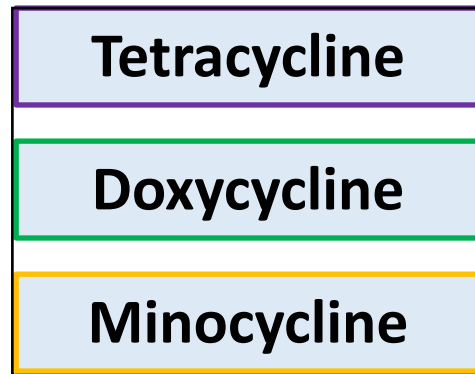
Broad spectrum agents. Gram positive activity more limited than Gram negative Resistance is common, so susceptibility testing essential

Binds to 30S ribosomal subunit reversibly - bacteriostatic



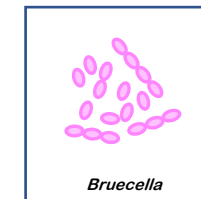
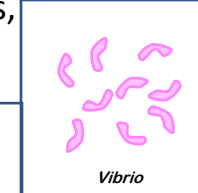
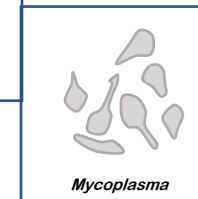
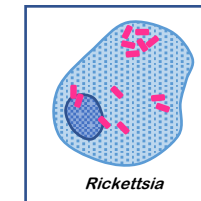
Increasingly important as MRSP becomes more common

Increasing Lipophilicity

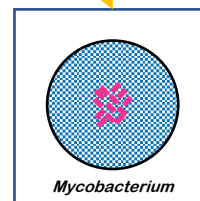
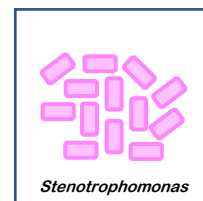


What does increasing lipophilicity mean for you as a clinician?

The 'weirdos', intracellular parasites, *Mycoplasma*



Minocycline has activity against *Stenotrophomonas* and *Mycobacterium marinum*

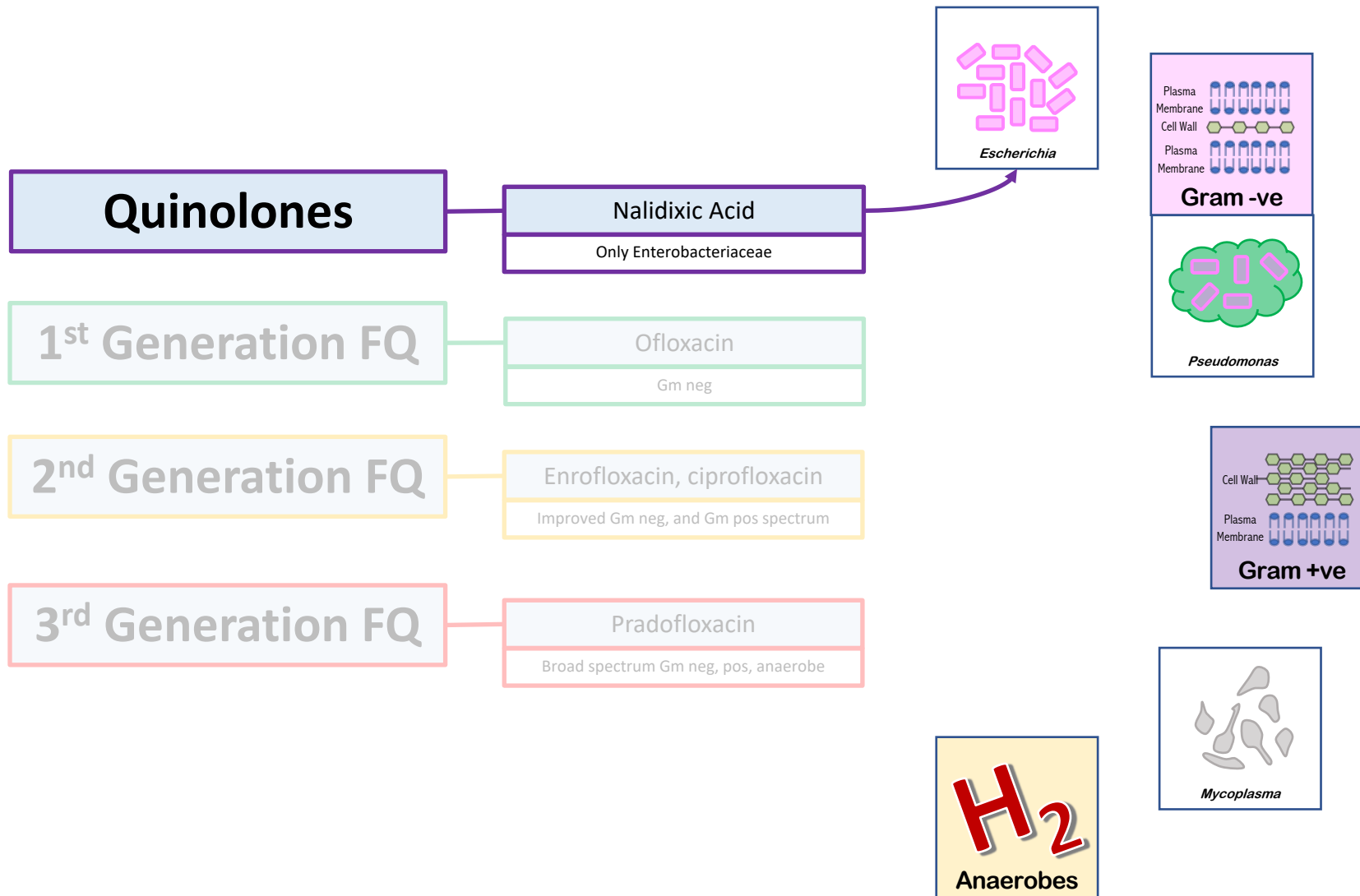


Mechanisms of Tetracycline Resistance

- Efflux
 - Common in Gram positive and negative
 - Resistance not necessarily across class...
 - If you want to use a drug test it!
- Ribosomal protection
 - Very common
 - *S. pseudintermedius* (tetM)
 - Conformational change in tetracycline binding site on 30S subunit of ribosome
- Ribosomal mutations, enzymatic inactivation also occur

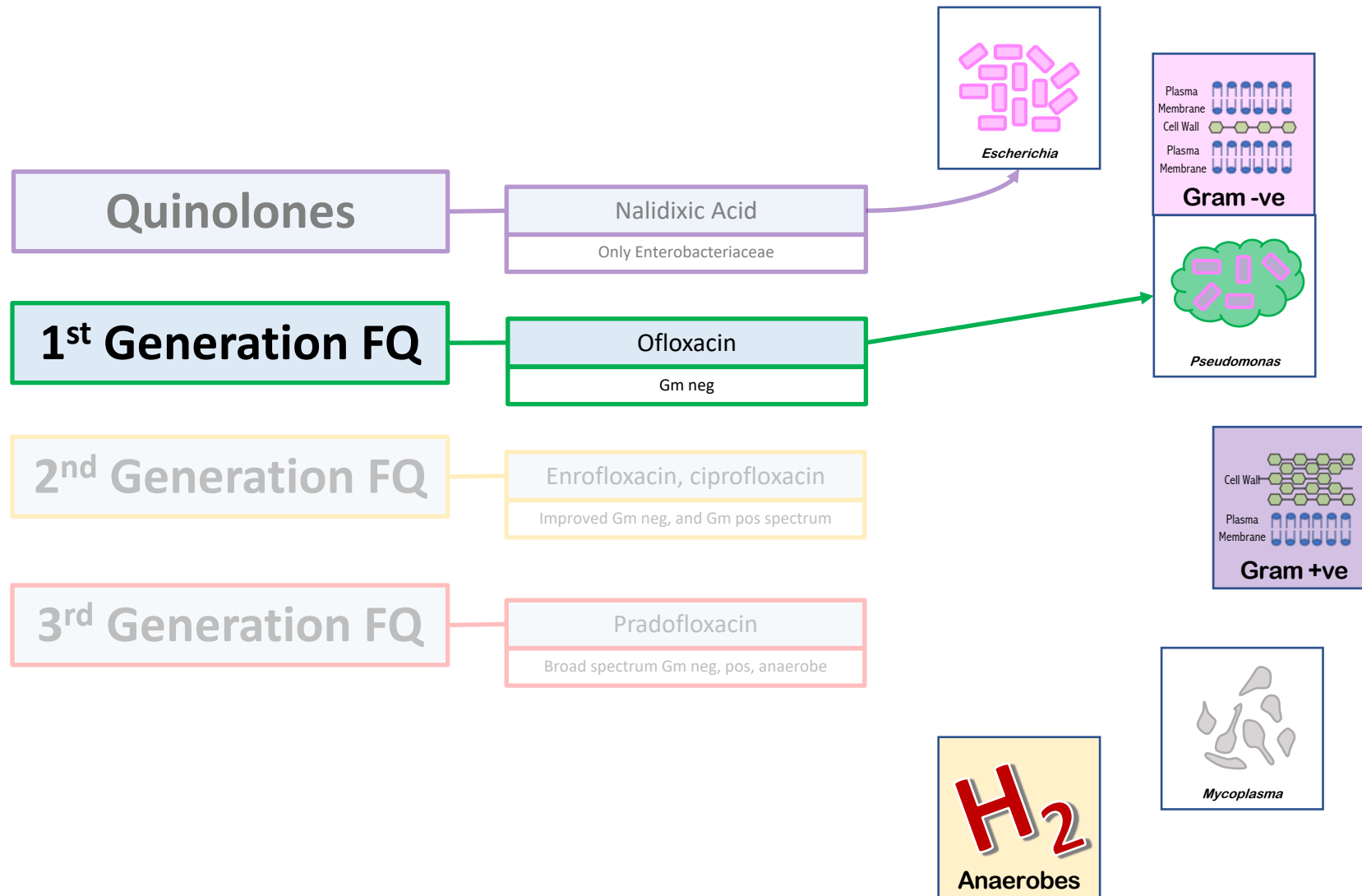
(Fluoro)quinolones

Inhibits DNA gyrase and topoisomerase IV,
prevents replication and organization
(supercoiling) - bactericidal



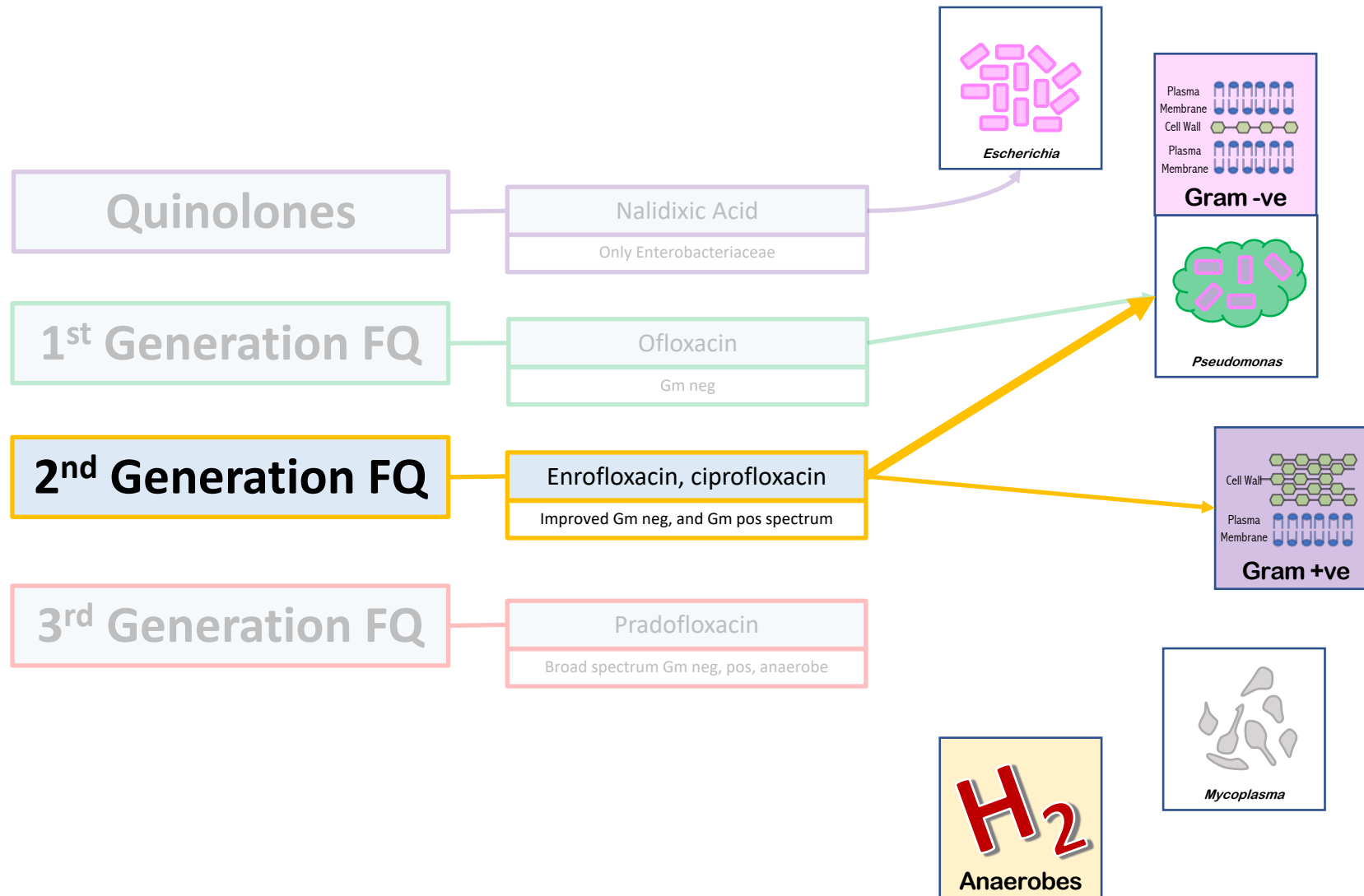
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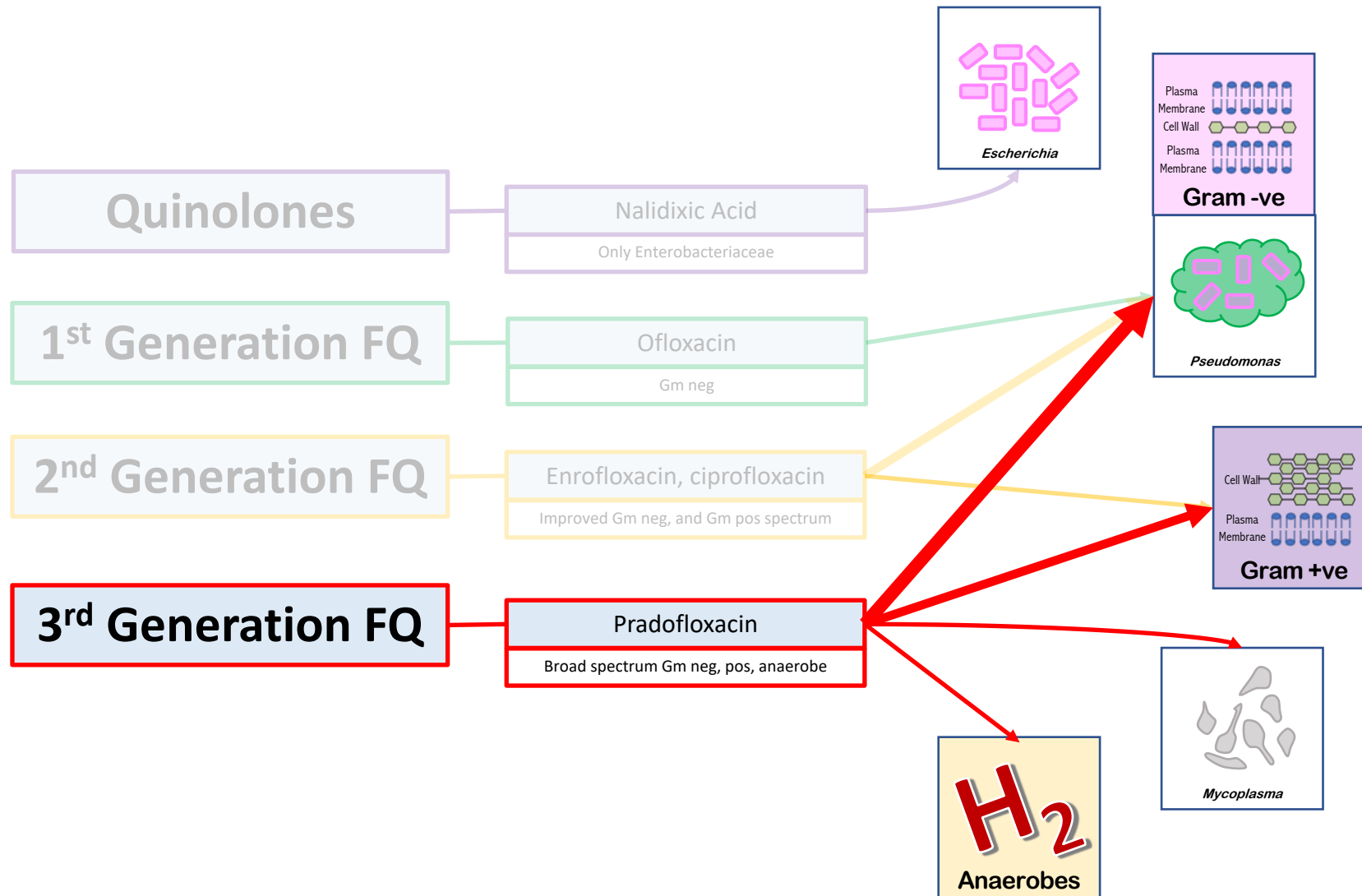
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(Fluoro)quinolones

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(Fluoro)quinolones

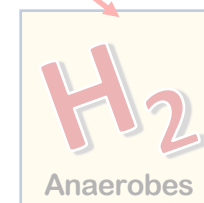
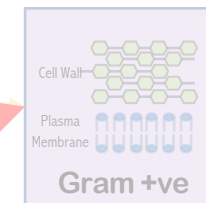
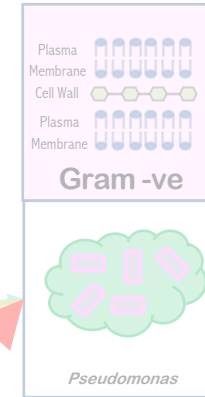
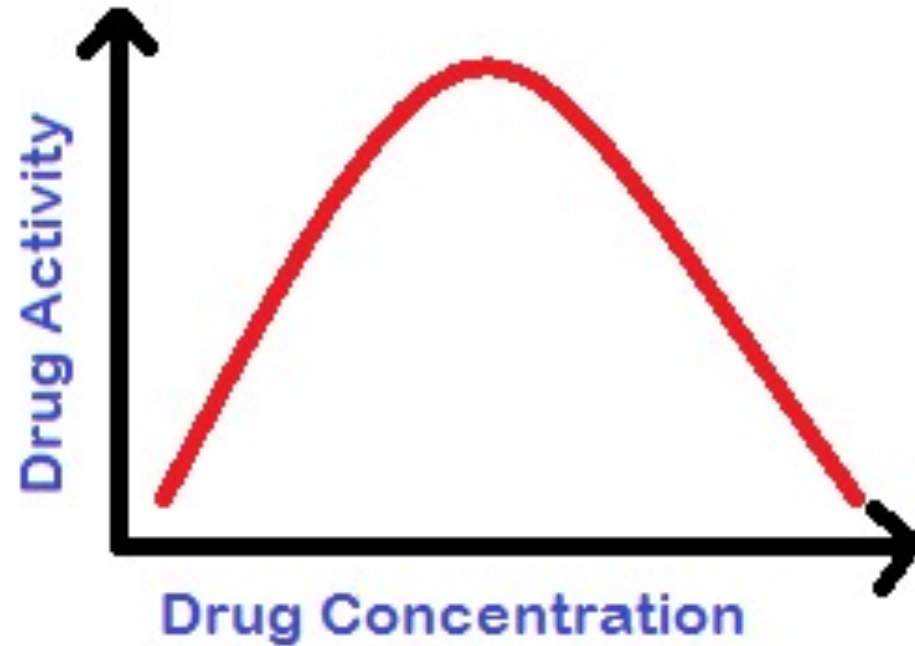
Inhibits DNA gyrase and topoisomerase IV, prevents replication and organization (supercoiling) - bactericidal

Quinolones

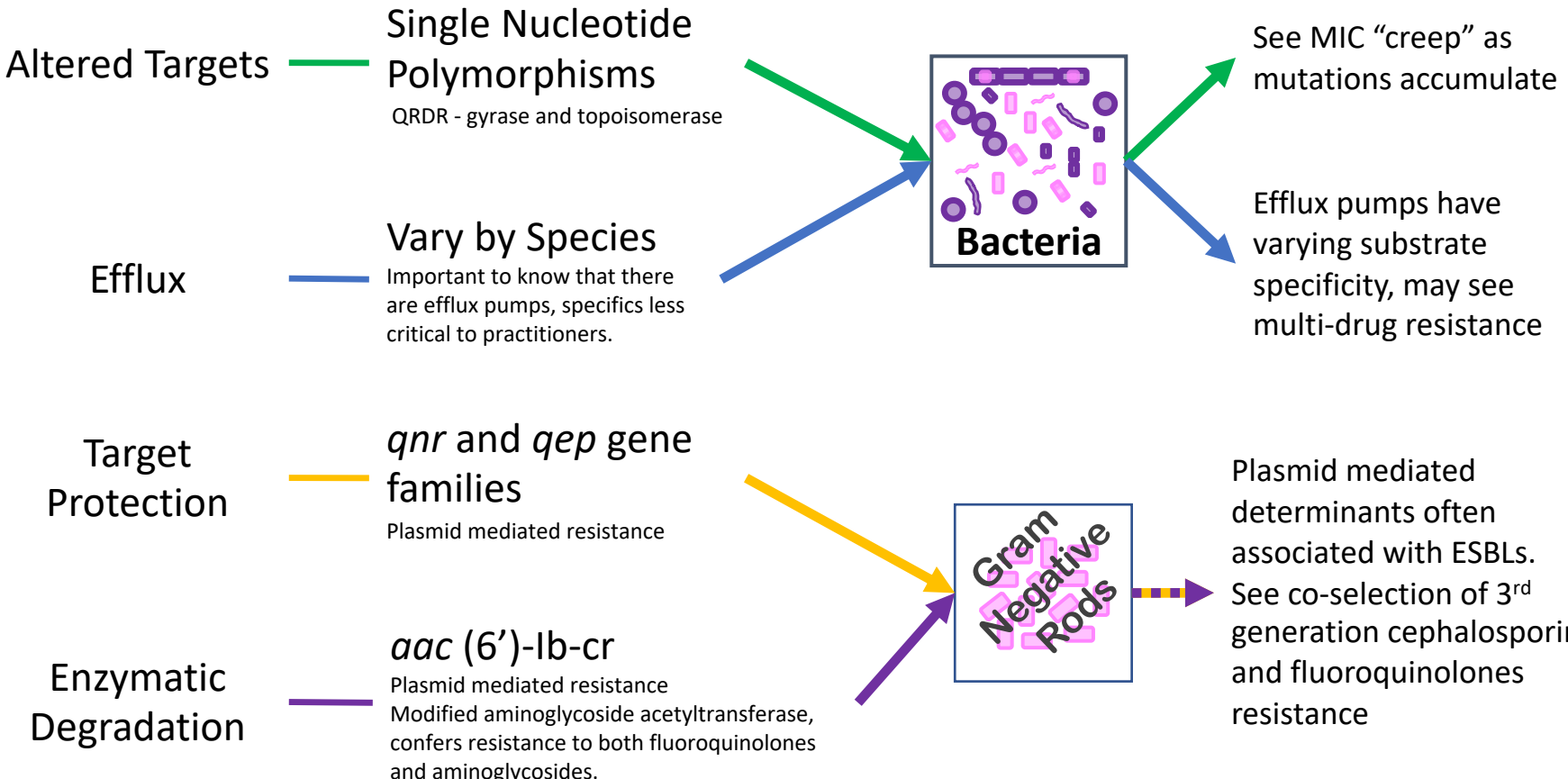
1st Generation

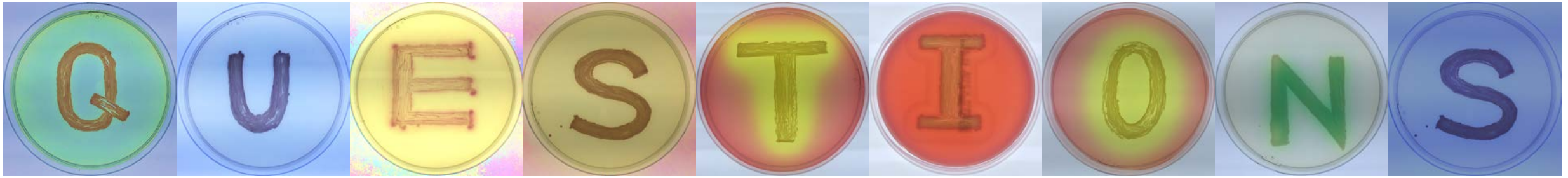
2nd Generation

3rd Generation



Mechanisms of Resistance






CVMA-ACMV Chapter SBCV
CVMA-SBCV Chapter

SPRING SUNDAY CE SESSIONS

ONLINE, INTERACTIVE, IN REAL-TIME
Four Sundays, Six CE Credits Each—Take One Sunday or Take Them All

SUNDAY	SUNDAY	SUNDAY	SUNDAY
March 13, 2022	April 3, 2022	April 10, 2022	April 24, 2022
GENEROUSLY SPONSORED BY  	GENEROUSLY SPONSORED BY  	GENEROUSLY SPONSORED BY  	GENEROUSLY SPONSORED BY  