

# Feline Lower Urinary Tract Disease - Causes and Management

**Daniëlle Gunn-Moore**

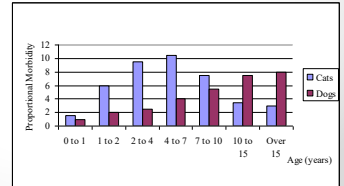
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Taylor et al., 2025 iCatCare consensus guidelines on the diagnosis and management of lower urinary tract diseases in cats, JFMS 2025

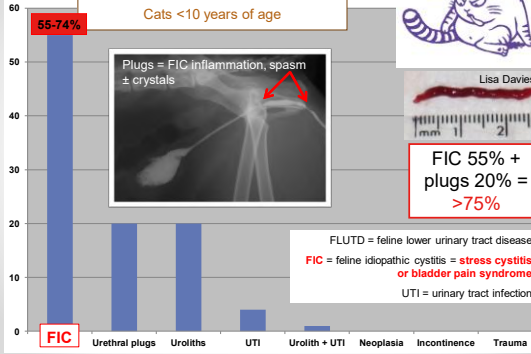
## Prevalence of FLUTD

- ❖ In UK ~ 10%
  - ❖ Hx of haematuria in >90% behavioural periuria cases
- ❖ Young-middle aged
- ❖ Over-weight
- ❖ Dry diet
- ❖ Indoor litter box
- ❖ Persian + BW DSH
- ❖ Males + females
- ❖ Multi-cat house

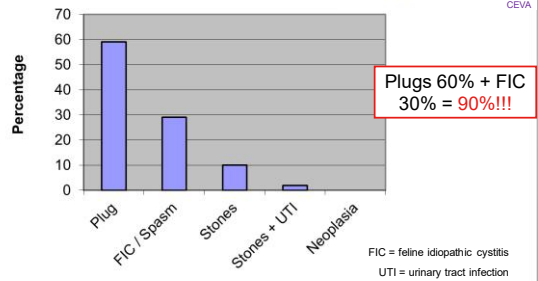


## Causes of FLUTD

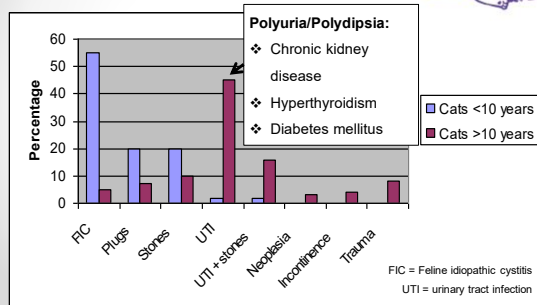
Cats <10 years of age



## Causes of Obstructive FLUTD



## Causes of FLUTD



## FIC - Effect of stress

- ❖ Sensitive individual in a provocative environment
- ❖ Altered responses to environmental stress
- ❖ Exaggerated arousal (fearful cats)
- ❖ Genetic v developmental
- ❖ Effects brain, spinal cord + bladder wall = "bladder migraine"
- ❖ Stressors
  - Multi-cat household → inter-cat conflict
  - Single-cat household → separation anxiety
  - Moving house
  - Meal fed, unsuitable litterbox + other key resources
  - Chronic v acute stress



## What are the 4 F's of stress?

- **Flight** – tries to escape from the fearful stimulus (*avoidance*)
- **Fight** – outward aggression; occurs when no escape route (*repulsion*)
- **Freeze** – initial response to fearful stimulus (*inhibition*)
- **Fidget** (ie faff & fiddle about) 'displacement' behaviour e.g. ↑ grooming (*appeasement*)



## Effect of stress



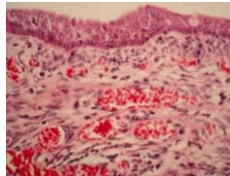
### Normal cats

- ❖ Fear, aggression, hiding, anorexia, weight change
- ❖ ↑ activity in hypothalamus (↑CRF) →
- ❖ Brainstem nuclei + locus coeruleus (LC) (*vigilance + autonomic activity*) → ↑sympathetic nervous system (SNS)
- ❖ Anterior pituitary (↑ACTH) → adrenal glands (↑cortisol)
- ❖ Activation of hypothalamic-pituitary-adrenal axis

### FIC cats

- ❖ Displacement activity (↑ eating ... drinking, grooming + urinating)
- ❖ ↑↑↑ activity in hypothalamus, ant. pituitary, LC + SNS
- ❖ No ↑ plasma cortisol
- ❖ Uncoupling of hypothalamic-pituitary-adrenal axis
- ❖ Chronic stim. → down-reg. of α2 adrenoceptor agonists receptors?

## Changes in nerve supply



- ❖ ↑ pain fibers (*C fibers*)
- ❖ ↑ pain receptors (*substance P receptors*)
- ❖ Stimulation of the C fibers (*via central "stress" or local triggers*) → release of Substance P (+ other neuropeptides) → pain, vasodilatation, ↑ vascular + bladder-wall permeability, oedema, smooth muscle contraction, + mast cell de-granulation  
= *neurogenic inflammation of the bladder wall*

## Other Changes

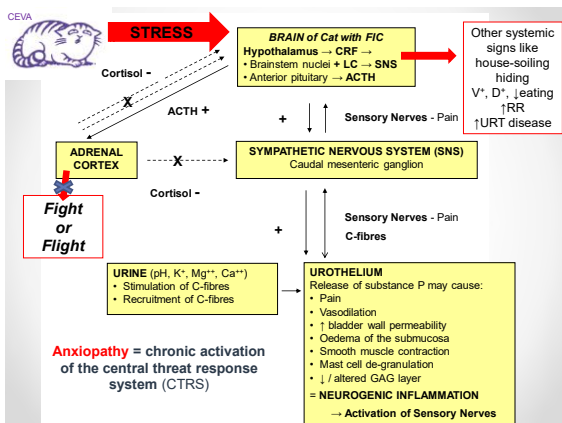


### Glycosaminoglycan (GAG) layer

- ❖ Lines the bladder wall
- ❖ Cats with FIC → altered +/- GAG in urine vs normal
- ❖ Defects → ↑ bladder wall permeability + allow stones to adhere

### Urine

- ❖ Is a noxious substance
- ❖ → acid, K<sup>+</sup>, Mg<sup>++</sup>, Ca<sup>++</sup>
- ❖ → stimulate nerve endings
- ❖ → recruit (pain) C-fibres



## Urolithiasis

Kopecny et al., 2021

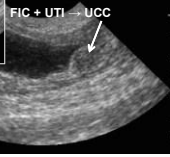
	1981	2005	2018
❖ Struvite	80	50	55%
❖ Oxalate	1-15	42	38%

- ❖ Stones v crystals
- ❖ Variable appearance
- ❖ Older cats:  
→ ↓ urine pH → ↑ oxalate
- ❖ Check serum Ca<sup>++</sup> - **35% are ↑**



## Role of Stress in other causes of FLUTD?

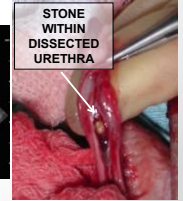
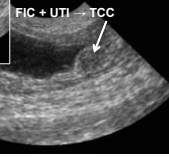
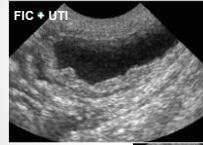
- ❖ Cats with FIC → ↑↑↑ risk of UTI  
Referral (<5%) vs GP (11-22%)  
Catheterisation → UTI (→ 60% in 3d)  
PU post FIC → UTI in up to ~60%
- ❖ Chronic FIC → ↑↑ risk of UCC
- ❖ Role of stress on oxalate stone formation?



Griffin + Gregory, 1992; Bommer et al. 2012; Griffin et al., 2020

## Role of Stress in other causes of FLUTD?

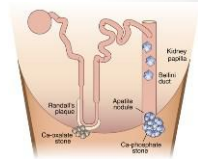
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- ❖ Role of stress on oxalate stone formation?



Griffin + Gregory, JAVMA, 200: 1992; Bommer et al JFMS, 2012

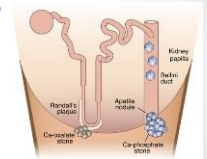
## Role of Stress in oxalate urolithiasis?

- ❖ Hypothalamic-pituitary secretion of vasopressin (ADH) → hypertonic urine
- ❖ Adrenocorticotrophic hormone (ACTH) → 2° ↑ PTH → ↑ serum calcium conc. → ↑ Ca<sup>++</sup> urine



## Role of Stress in oxalate urolithiasis?

- ❖ ↑ systemic & GIT inflammation & oxidative stress → ↑ GIT oxalate absorption → ↑ serum oxalate conc. → ↑ oxalate urine
- ❖ Supersaturated urine → renal damage by oxidative stress → inflammation →
- ❖ Randall's plaques on renal papillary surfaces where CaOx stones develop
- ❖ Non-dissolvable
- ❖ Ureteral stones ...



## Treatment

- ❖ Relieve obstruction: covered by Professor Chanoit
  - ❖ Treat primary cause: not discussed in this talk
    - Remove stones
    - Treat urinary tract infection (UTI)
    - Treat neoplasia
  - ❖ Manage clinical signs of FIC
    - Alter urine + bladder **AND** ↓↓ stress
- } Remember the role of stress



## Prognosis

- ❖ Obstructed vs non-obstructed  
Re-obstruction → 60% within a year, most <7 days  
Very dependant on significant management changes  
MEMO\* 85% recovery, my study >94%
- ❖ Obstruction: FIC, stones, plugs
- ❖ 50% recurrent signs
- ❖ 30% recurrent obstruction
- ❖ 20% euthanased



\*MEMO = Multimodal Environmental Modification

Gunn-Moore + Shenoy JFMS 2004  
Buffington et al. JFMS 2006  
Gerber et al JFMS 2008

## FIC - management

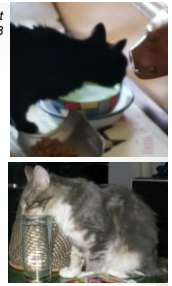


- ❖ aka bladder pain syndrome
  - ❖ ↑ water intake → ↓ USG
    - ❖ Water v food
  - ❖ ↓ stress
    - ❖ Environmental changes – ↓ group size, environmental enrichment, etc.
    - ❖ Anti-depressants
  - ❖ Relax urethra
  - ❖ Replace urinary GAGs
  - ❖ Multi-modal management
- ❖ Cats do not like PO meds ...

## FIC - ↓ USG

Handl & Fritz Vet Focus 2018

- ❖ ↑ water intake
- ❖ Try to ↑ water turn over & dilute noxious substances
- ❖ Free access to water
  - Clean, rain?
  - Bowl (<15cm), deep, full, access
  - Away from food; Raised?



Stephanie Brickman; Blue 14y

Sarah Ellis; Bailey 16y

Blackberry; Ben Blacklock



## FIC - ↓ USG



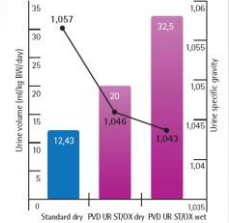
Gunn-Moore & Shenoy JFMS 2004

- ❖ Diet → urine concentration, volume, pH, & mineral content
- ❖ 'Soups'
- ❖ Hydracare™
- ❖ Moist > dry diet
- ❖ Aim: urine USG <1.035 (>94% success)



## FIC - Diet

- ❖ Diet → urine concentration, volume pH + mineral content
- ❖ Moist > dry diet
  - Purina UR ST/Ox
  - Hill's c/d Multicare & Urinary Stress
  - Royal Canin Urinary SO, etc.
- ❖ Aim: urine USG <1.035 (>94% success)



Urine volume and specific gravity in cats fed UR ST/Ox™ dry and wet formulas vs. cats fed standard dry diet (Average from 139 cats tests performed on Nestlé Purina PetCare)



	NESTLÉ PURINA		Hill's			Royal Canin		
	UR ST/OX CHICKEN OR OCEAN FISH	UR ST/OX CHICKEN, SALMON OR TURKEY	c/d multi-care**	c/d multi-care	c/d multicare reduced calorie***	Urinary SO†	Urinary SO	Urinary Moderate Calorie†
	Dry	Wet	Pouch	Dry		Aludray		Dry
Moisture	6.5%	80%	75%	5.5%	5.5%	80%	7%	7%
Protein*	37%	50%	42%	34%	38%	35%	37%	37%
Fat*	13%	26%	19%	16%	11%	25%	16%	12%
Na*	1.3%	0.9%		0.3%		0.75%	1%	1.2%
Urine pH	6.0-6.3	6.0-6.3		6.2-6.4		6.6-6.7	6-7	
Urine SG	~1.046	~1.043		<1.040		~1.035	~1.050	
Urine Volume	~20 ml/kg/day			~10 ml/kg/day		~17 ml/kg/day		
RSS / APR Struvite	<1 / <1							<1 / ND
RSS / APR Oxalate	<10 / <5							<12 / ND
Added	†Na, †Omega 3+6, Vit E + B <sub>6</sub> , GAGs ...			‡citrals, Omega 3+6 FA, Vit E, b-carotene, Vit B <sub>12</sub> ...				†Na, Omega 3+6 FA

\*Dry matter

\*\* Cans available

\*\*\*20% less calories; chicken or fish flavours

# Pouch available

## FIC - Diet

- Hill's c/d Urinary Stress - also contains L-tryptophan + milk protein hydrolysate to ↓ stress, + ↑ GAG's



### Hill's c/d Multicare\*:

- ❖ 1 year, double-blind placebo controlled
- ❖ Wet or dry versions
- ❖ Acute FIC, single-cat households
- ❖ N=14 on control diet v 11 on test diet\*
- ❖ 64% v 36% episodes of recurrence
- ❖ 11.2 v 1.3 incidence rate/1000 study days = ↓89% incidence rate

### Hill's c/d Urinary stress

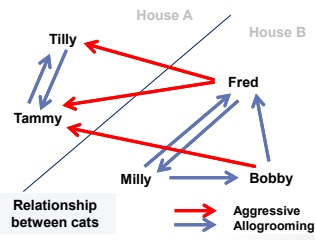
- ❖ 5 weeks n=31
- ❖ Recurrence (5/17) signif. lower than control (11/14)

Naarden & Corbee 2020

Kruger et al. 2015



## Behaviour



### Reduce stress - other cats:

#### Plentiful resources → social groups

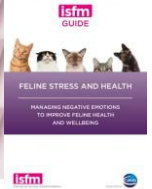
Key recourses – food, water, latrine, resting places, hiding place / escape route, scratching post ± companionship



## ISFM Environmental needs guidelines

### Five pillars of a healthy feline environment

- Pillar 1**  
Provide a safe place
- Pillar 2**  
Provide multiple and separated key environmental resources: food, water, toileting areas, scratching areas, play areas, and resting or sleeping areas
- Pillar 3**  
Provide opportunity for play and predatory behavior
- Pillar 4**  
Provide positive, consistent and predictable human-cat social interaction
- Pillar 5**  
Provide an environment that respects the importance of the cat's sense of smell



## FIC - ↓ stress

### Access to key resources

- How many GROUPS of cats are in the household?

**Key Resources** = feeding stations, water stations, litter boxes, resting places (high up), hiding places / escape routes



## FIC - ↓ stress

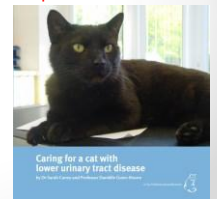
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- ↓ overcrowding
- ↓ urination stress

- Number + type of litter box
- Open vs covered
- Where are the box(es) is positioned
- Type of litter?
- How is the box cleaned ...



## FIC - ↓ stress

- Pheromones *Feliway Classic / Friends / Optimum Zenifel*

- Anxiolytic *Pet Remedy*

- Milk protein hydrolysate

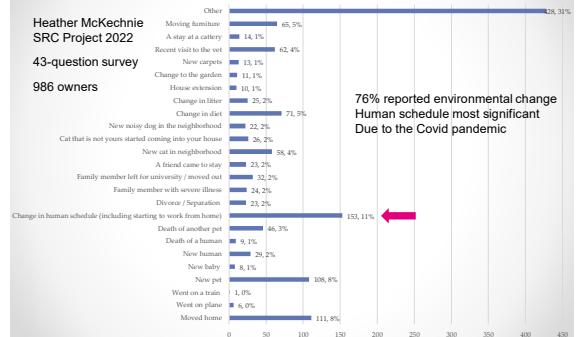
Zylkène, Hill's c/d Urinary Stress, Royal Canin Calm



Gunn-Moore + Cameron JFMS, 2004; Beata et al J Vet Behav 2007



## Were there any recent changes at home (in the past ~6 weeks) before the cystitis first started or recurred?

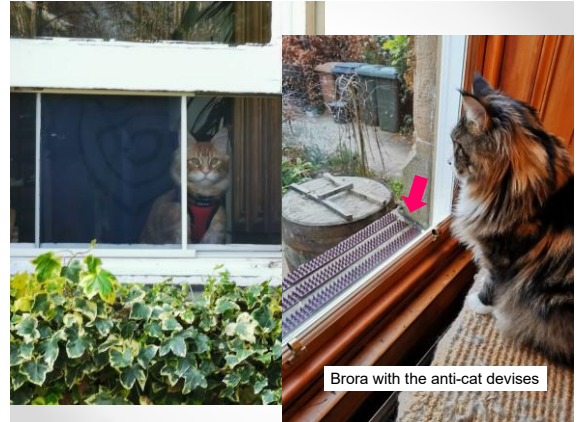


## FIC - ↓ stress

- ❖ Owner stress
- ❖ Changes in diet
- ❖ Environment - indoor
  - Environmental enrichment:
- ❖ Environment - outdoor
  - Stress from cats outside, bad weather



For Cat Owners | Indoor Pet Initiative (osu.edu)  
<https://indoorpet.osu.edu/cats>



## Home Feline Stress Score

### Home Feline Stress Score for Owners

- ❖ Spending more time sitting/hiding in unusual places
- ❖ ↑ attention/love seeking
- ❖ Being scared more easily
- ❖ Urine spraying – by neutered apparently healthy cats
- ❖ Urinating indoors anywhere other than in a litter box



Glebocka MJ, Domingues M, Donoghue OJ, Miele AC, Caney SMA, Gunn-Moore DA

## FIC - ↓ stress

Buffington et al JFMS 2006

### MEMO

- ❖ Multimodal Environmental MODification
- ❖ Follows a detailed owner questionnaire
- ❖ Ensure each GROUP of cats has access to its own:
  - Feeding + watering stations, litter box(es), resting place(s), hiding place(s) / exit route(s), scratching post

### Changes include:

- ❖ Client education
  - ❖ Changes in the cat's:
    - Interaction with other cats (other pets)
    - Interaction with owners
    - Environment
    - Diet
- = 85% recovery**

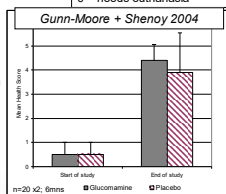


## GAG layer



- ❖ PO N-Acetyl glucosamine
  - Gunn-Moore + Shenoy JFMS 2004
  - Panchaphanpong et al. JFMS 2011
  - 19 v placebo 10 cats; ↑ plasma GAG after 21d
  - ~ ↓ haematuria; ↓ pain on urination??
- ❖ PO or parenteral PPS
  - Chew et al. JVIM 2009, 144 cats, PO, 6m
  - No difference between the groups
  - Wallius + Tidholm JFMS 2009
  - 18 cats; SQ d1,2,5,10, 1y;
  - 33% recurrence in both groups

Mean Health Score  
 5 = clinically well  
 0 = needs euthanasia



## GAG layer



- ❖ Intravesical
  - PPS - Delille et al. JFMS 2016; 35 cats; 0, 24, 48h; 5d
  - No difference in clinical signs
  - Hyaluronic acid, chondroitin sulphates + NAG: A-Cyst®
  - Bradley + Lappin JFMS 2013; 0, 12 + 24h; 3/7 placebo cats re-blocked within 7d; 0/9 Tx did not; no statistical difference
- ❖ They may help some cats ...
- ❖ Continuous or episodic Tx
  - Oral N-Acetyl glucosamine, also contains hyaluronic acid, plus L-tryptophan to ↓ stress - Cystease®
  - PO or parenteral PPS - Cartrophen®

## Antispasmodics

Galluzzi et al 2012, Hetrick + Davidow JAVMA, 2013, Reineke et al., 2017, Hanson et al., 2021, Conway et al., 2022

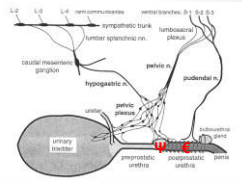
### Smooth muscle relaxants (anti $\alpha$ adrenergics)

<b>Acepromazine</b>	IV, IM, SC, PO
<b>Prazocin<sup>W</sup></b>	0.5-1.0 mg/cat PO q8-12 hours
Phenoxybenzamine	5 days to act, PO
Amitriptyline*	0.5-1.0 mg/kg PO q24 hours

### Skeletal muscle relaxants

<b>Dantrolene<sup>E</sup></b>	(IV), PO
<b>Diazepam</b>	IV, PO
<b>Atracurium bensiylate</b>	urethral flush?

\* Ureteral + urethral



## Anti-depressants

Chew et al 1998; Krajer et al 2003; Kruger et al 2003

### TCA's

#### Behavioural + organic effects

- anti-cholinergic ( $\uparrow$  bladder capacity)
- anti-inflammatory ( $\downarrow$   $H_2$  from mast cells)
- anti-adrenergic, analgesic, anti-depressant
- ureteral + urethral relaxant
- $\downarrow$  interstitial inflam. in blocked kidneys?

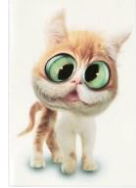
#### Side effects - obesity, somnolence, hepatopathy

#### For severe chronic cases ...

#### Not licensed in the cat

**Amitriptyline, Clomipramine**

**SSRIs - fluoxetine (Prozac)?**



## Others ...

- Chloramphenicol - no effect
- Corticosteroids - no effect
- Phenazopyridine - toxic, methaemaglobinaemia
- Hydroxyzine ( $\alpha$ histamine; Lappin) - no effect
- Oxybutynin ( $\alpha$ cholinergic &  $\alpha$ spasmodic; Lappin) - no effect
- Chinese herbs (San Ren Tang, Wei Ling Tang, Alisma) - no effect
- Chinese herbs (Takushya portion of chorelto) -  $\downarrow$  struvite
- Cranberry extract -  $\downarrow$  signs of FIC in 10 cats over 2 months
- L-theonine - (glutamate analogue) -  $\downarrow$  stress 30/33 cats...  
Anxitane<sup>TM</sup> very palatable tablets ...
- Low dose radiotherapy - 16 cats, NC State

Daniels et al. 2018, Buffington et al 1997, Niyom et al. 2013; Sönmez & Kozanhan 2017; Dramard et al. 2018; Colombino et al. 2021



## Others ...

- Buprenorphine, other opiates
- NSAIDs - care! - no effect on recurrence ...
- Intravesical lidocaine - no effect
- Maropitant - NK-1 antagonist, visceral analgesic + ...?
- Nerve growth factor antibodies (Solensia<sup>TM</sup>) ...?
- Gabapentin or pregabalin or trazadone?
- Acupuncture?
- Duloxetine?
- Montelukast (Singulair)?
- TNF alpha blockers?
- Adipose derived stem cells?

Daniels et al. 2018, Buffington et al 1997, Niyom et al. 2013; Sönmez & Kozanhan 2017; Dramard et al. 2018, Rubini et al., 2025



## Management of FIC

### Management is palliative

- MEMO
- $\downarrow$  stress
- Feed appropriate (wet) diet
- Anti-spasmodics
- GAG supplementation
- Tricyclic anti-depressants
- Monitor closely ...
- Re-home



Medicat

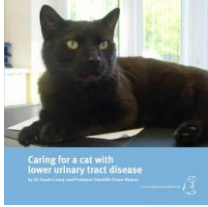
**Monitor closely**

Caring for a cat with urinary stress-related disease  
catprofessional.com

'Pee cam' Tobbi, owner Rhona Tamosiunas



Remember, it is all about reducing stress!



**Thank you!**  
**Any questions?**