

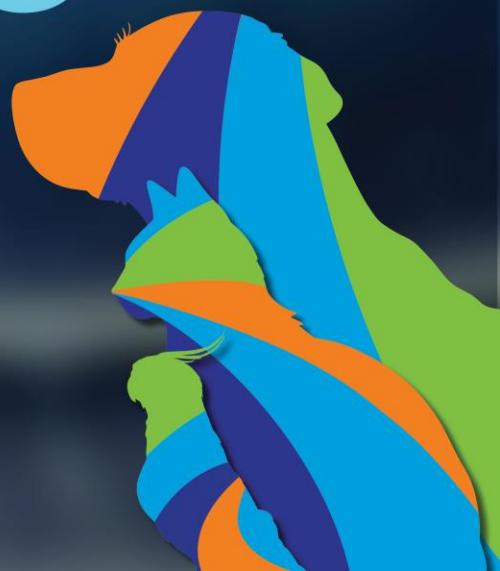


JANUARY 17-21 • NAVC.COM • ORLANDO, FL

# WORLD CLASSIC

CELEBRATING THE CHAMPIONS OF CARE

**VMX**  
VETERINARY MEETING & EXPO



# SO, YOU THOUGHT IT WAS ADRENAL DISEASE...COMMON MISTAKES IN ENDOCRINE DIAGNOSTICS

PATTY LATHAN

BILL SAXON

- Identify common challenges in diagnosing endocrine diseases, including low prevalence, nonspecific signs, and test interference.
- Apply a practical, case-based approach to selecting appropriate endocrine tests and determining optimal timing for testing.
- Interpret endocrine test results accurately, considering potential confounding factors from concurrent disease or medications.

# **CONFLICT OF INTEREST DISCLOSURE**

**Dr. Lathan: Consulting for Idexx, Boehringer Ingelheim, and ScoutBio.  
Honoraria from Idexx, BI, and Dechra.**

**Dr. Saxon is a full-time IDEXX employee.**

# ADRENAL

# **CUSHING'S SYNDROME PITFALLS AND TIPS**

- Screening wrong patient – dog and cat
- Screening at the wrong time (when sick)
- Confusion over which screening test
- Not monitoring BP, proteinuria (other complications)
- Best monitoring practice
- Test interpretation practice (later)

# LDDST TIMING: HOW CRITICAL?

- How far off from 4 and 8 hours before need to re-run test?
- What if dog highly stressed – okay to send home between samples?
- Sedation interfere with test?

## SUSPECT EEH WHEN:

- **Gastrointestinal signs**
  - **Megaesophagus?**
- **Albumin: globulin <1.08**
  - Over 1/3 hyperglobulinemic
  - Hypoalbuminemia more common w EEH
- **Low cholesterol (<3.43 mmol/L)**
- **Lack of stress leukogram in sick animal**
  - Lymphocyte count >1500–1750 cells/ $\mu$ L
  - Eosinophil count >500 cells/ $\mu$ L
- **Reticulocytosis without anemia**
- **Increasing Ca, decreasing BG, regurgitation...**

EEH in 30-40% of Addisonian dogs  
Cats get it too.

# ACTH STIMULATION TEST DOSING

- IT'S NEVER MEDICALLY WRONG TO USE THE WHOLE VIAL (250 mcg)
  - \$\$\$
- Addison's diagnosis
  - 1 mcg/kg or more
- Cushing's
  - Diagnosis
    - 5 mcg/kg
  - Monitoring
    - 1 mcg/kg (or more)

I'm seeing a consult this week, 9yo mixed breed dog that was diagnosed with Addison's via stim at my hosp (through ECC), started on docp and pred. Then like a month later, the pDVM did another stim and values were: pre 4.3, post 5.0

OOPS...**WHY** DID WE DO IT AGAIN???

I'm seeing a consult this week, 9yo mixed breed dog that was diagnosed with Addison's via stim at my hosp (through ECC), started on docp and pred. Then like a month later, the pDVM did another stim and values were: pre 4.3, post 5.0

Is that just because the dog was on prednisone? And the cortisol assay was picking that up?

Yeah, prob the pred being picked up by the cortisol assay if they gave pred before coming in the hospital. I assume the initial stim was legit?

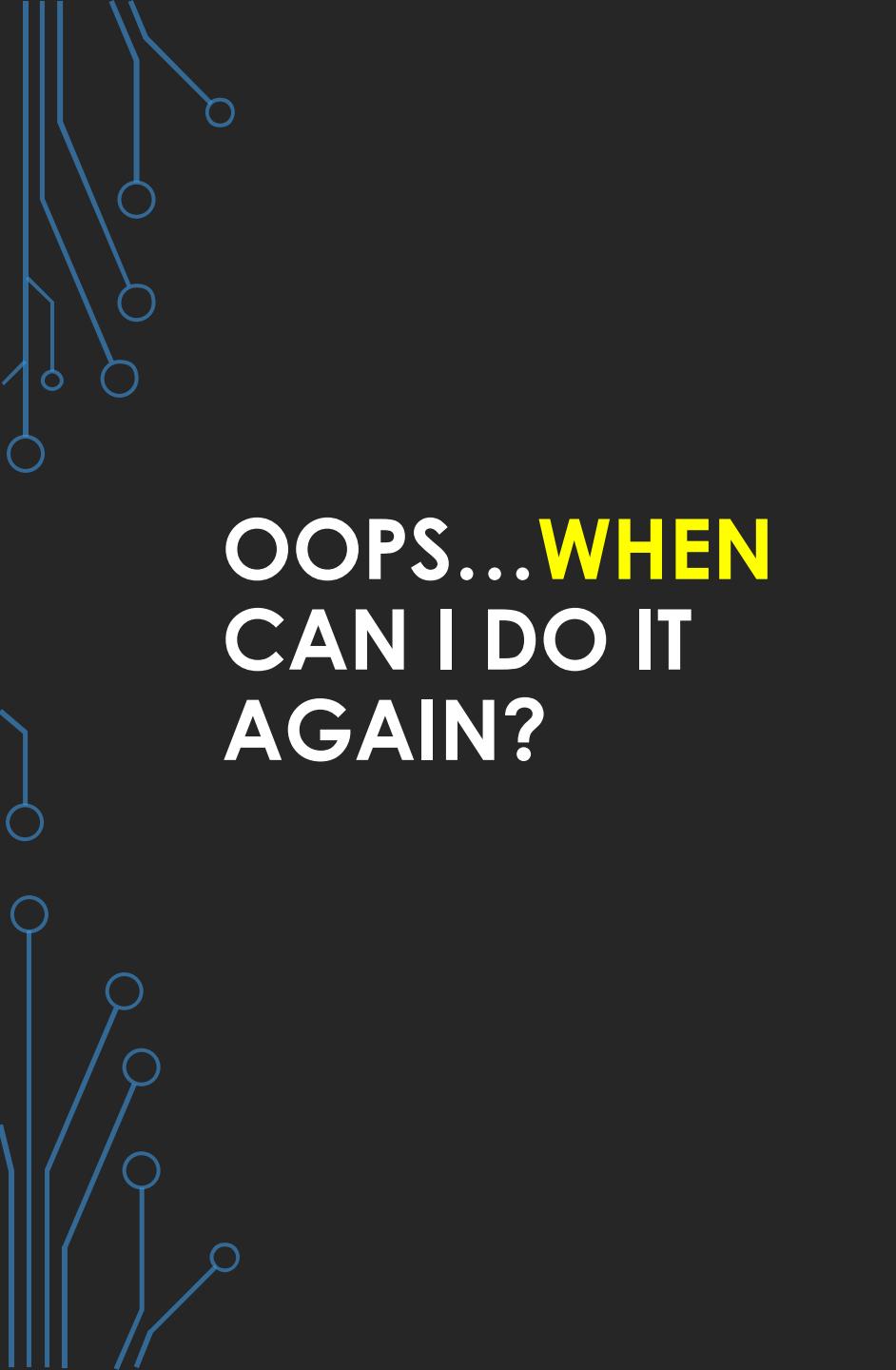
I wasn't there for it, but our criticalist did it so I assume so

It was pre 0.3, post 0.5 or something like that, both values less than 0.1

Sorry, less than 1.0

Yeah that's convincing.

**OOPS...WHY DID WE DO IT AGAIN???**



# OOPS...**WHEN** CAN I DO IT AGAIN?

- ACTH Stimulation test
  - Mistake: Using <5 mcg/dL for Cushing's test, results not positive
    - When to repeat: Next day
- LDDS
  - Mistake: Used 0.1 mg/kg instead of 0.01 mg/kg of dexamethasone, results not positive
    - When to repeat: 1 week later?
  - Other issue: Lipemic sample, need to fast longer and repeat
    - When to repeat: >1 day later
- LDDS following ACTH stim that's not positive: Next day
- ACTH stim following LDDS that's not positive: 1 week later?

# TRILOSTANE MONITORING: TIMING

- Pre-pill cortisol
  - Before the next pill (12 or 24h)
  - What if...?
    - They gave the pill...?
    - They usually give the pill at 5 am
    - Other?
- ACTH stimulation test
  - Start 3-5h AFTER pill
  - How much leeway on either side and still have 'accurate' test?

# THYROID

# CANINE HYPOTHYROIDISM PITFALLS AND TIPS

- Screening healthy dogs
- Not using breed-specific reference ranges
- Over-reliance on Free T4
- Under/over reliance on TSH
- Unnecessary extended panels
- Starting dose and monitoring
- Treatment trials – not using full dose, forgetting to stop, see if signs recur
- Treatment with comorbidities – heart disease, Addison's

# Assessment of the likelihood of hypothyroidism in dogs diagnosed with and treated for hypothyroidism at primary care practices: 102 cases (2016-2021)

Victoria Travail<sup>1</sup>  | Carolina Fernandez Sanchez<sup>2</sup> | Jose M. Costo<sup>3</sup> |  
Nicola Valentine<sup>4</sup> | Megan Conroy<sup>5</sup>  | Venessa Lee<sup>5</sup> | Dimitrios Bouziopoulos<sup>6</sup> |  
Kathryn Bateman<sup>6</sup> | Emma Gatehouse<sup>7</sup> | Judith Cruzado-Perez<sup>1</sup> |  
Danica Pollard<sup>8</sup> | Valerie Lamb<sup>1</sup> | Florence Juvet<sup>1</sup> | Darren Kelly<sup>1</sup> 

- Retrospective, 102 dogs
- 3 ECVIM diplomates evaluated records
  - Confirmed/likely: 38%, 48%, 56%
  - Suspected but not confirmed: 6%, 23%, 12%
  - HypoT4 unlikely: 4%, 23%, 14%
  - No reason to suspect: 52%, 7%, 19%
  - \*Levothyroxine supplementation not indicated in approx. 52% of cases
- **DO NOT TEST DOGS WITHOUT CLINICAL SIGNS OF DISEASE!**

# BREED MATTERS

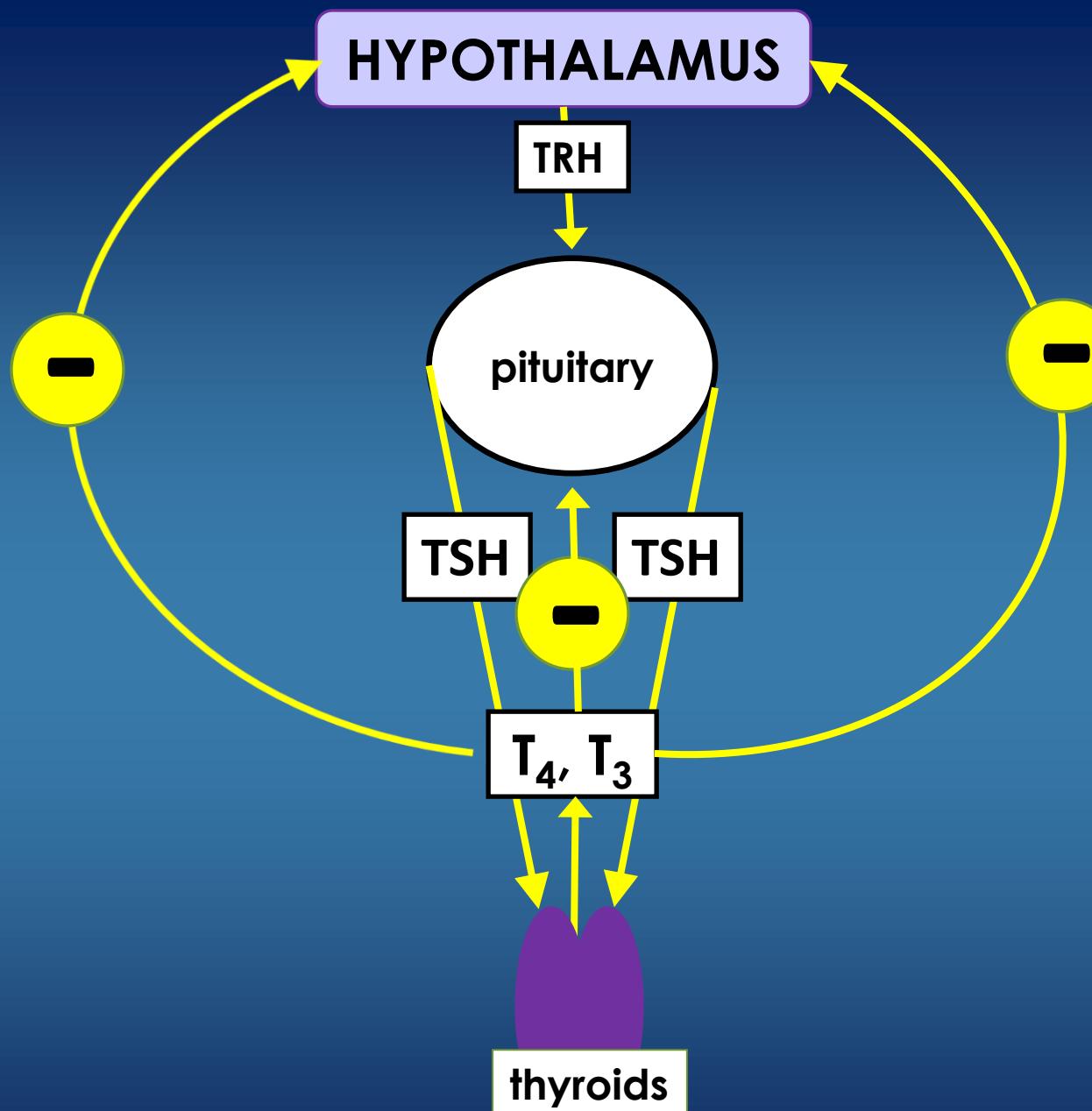
- Normal greyhounds
  - $\text{TT}_4$ 
    - 91% below ref interval
    - 16% below limit of detection
  - $\text{FT}_4$ 
    - 21% below ref interval
    - 13% below limit of detection
- Breed specific reference ranges if available
- Diagnose with:
  - Clinical signs, CBC/chem panel/UA,  $\text{TT4} + \text{TSH}$

**Not just greyhounds:**

- Whippets
- Salukis
- Borzois
- Sloughis
- Basenjis
- Scottish Deerhounds
- Irish Wolfhounds
- Alaskan sled dogs

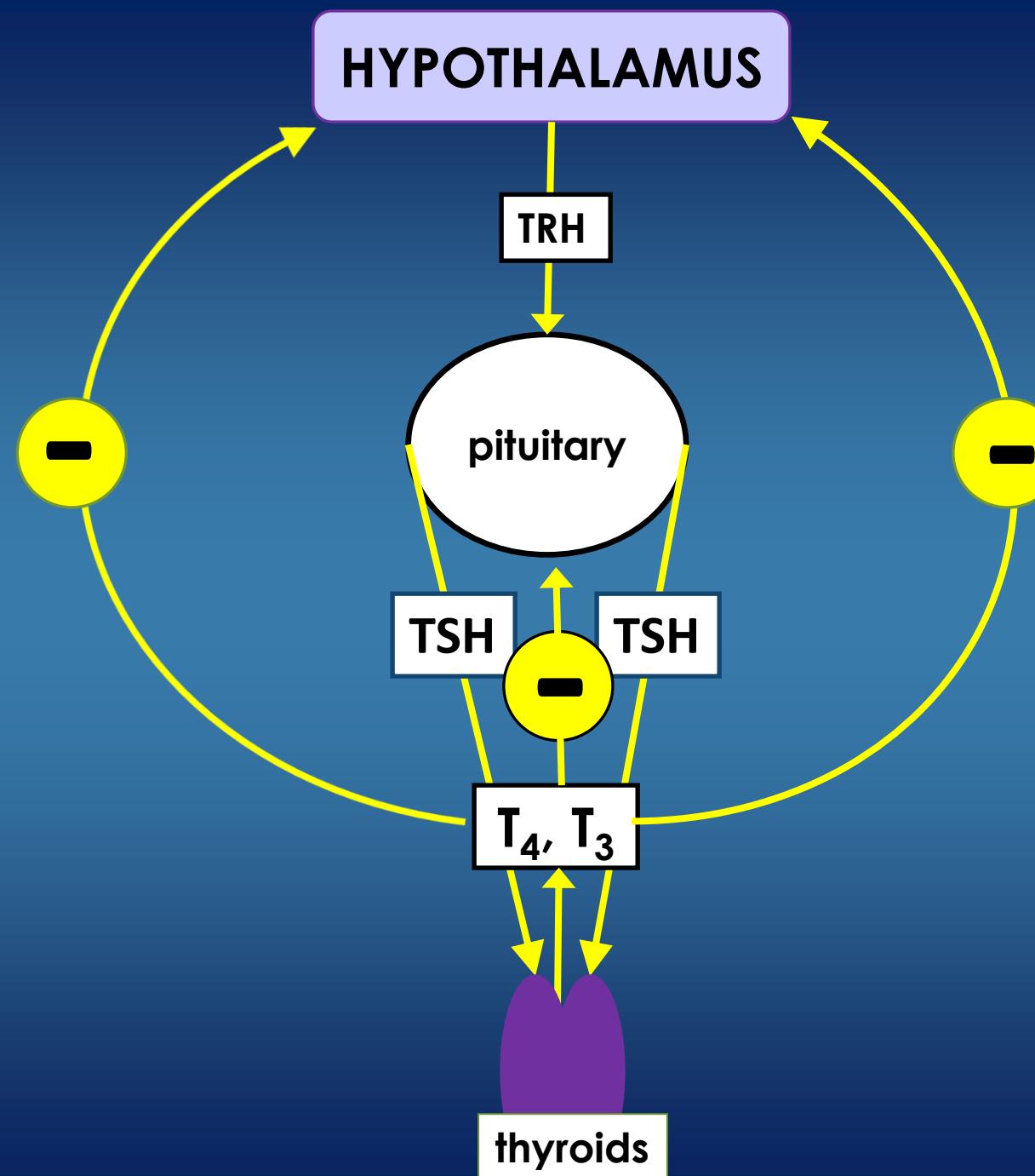
# HYPOTHYROIDISM TESTING: ELIMINATE CONFUSION

- Only patients with multiple signs and supportive lab changes
- Screen with TT4 → highly sensitive, specificity ok at 77%
- Normal TT4 (almost always) excludes hypothyroidism
- Low TT4 on senior panel
  - Look for some other disease unless *everything* points to hypoT4
  - Low suspicion → repeat TT4 in 1 month
  - High suspicion → TSH, +/- FT4 (ED)
- The issue with TSH
  - Normal in 30% of hypoT4 dogs, and positive in 10-20% of normal dogs ☹
- Treatment trial if results conflicting...use full thyroxine dose
  - 20 mcg/kg BID, 4-8 wk recheck
  - If objective improvement stop, if signs recur THEN diagnosis confirmed, restart



# HYPOTHALAMIC-PITUITARY-THYROID AXIS

## Hypothyroidism and Release from Negative Feedback



Hence:  
Little  $T_4$   
Big TSH  
Hypothyroidism



## Free Thyroxine Concentrations by Equilibrium Dialysis and Chemiluminescent Immunoassays in 13 Hypothyroid Dogs Positive for Thyroglobulin Antibody

J.F. Randolph, S.V. Lamb, J.L. Cheraskin, B.J. Schanbacher, V.J. Salerno, K.M. Mack, J.M. Scarlett, and N.J. Place

- 13 dogs with hypothyroidism
  - Based on low FT4 by equilibrium dialysis (ED)
  - WITH anti-thyroglobulin antibodies
  - Measured TT4 and FT4 on Immulite (NOT ED)
    - Commonly used by state and ref labs when ED NOT chosen
  - FT4 in or above rr in 2/8 dogs on Immulite

# OOPS...WHEN CAN I DO IT AGAIN? (THYROID EDITION)

- Timing post-T4 supplementation
  - 4-6 hours for peak
  - Prior to last pill for trough
    - (If concerns about over- or under-treating)
- Timing post-methimazole
  - ANY (after how long on therapy?)

**OOPS...WHAT IF TREATMENT WAS STARTED  
BEFORE THE DIAGNOSIS WAS CONFIRMED?**

*Standard Article*

*J Vet Intern Med* 2017;31:705–710

## Effects of Levothyroxine Administration and Withdrawal on the Hypothalamic-Pituitary-Thyroid Axis in Euthyroid Dogs

V. Ziglioli , D.L. Panciera, G.C. Troy, W.E. Monroe, K.M. Boes, and K.R. Refsal

- LT4 given to euthyroid dogs x 8 wks or 16 wks
- TT4, TT4(ED), TSH measured q weeks during and after tx (x 16 wks)
- STATISTICALLY “Recovered” 1 week following withdrawal
  - TSH was higher than baseline after the 1 week period
  - 1 dog had high TSH for 14 months (but normal TT4 and FT4)
  - Conclusion: testing 1 wk after stopping provides accurate assessment of thyroid function

# GIVING THE CORRECT LT4 DOSE: NOT WORKING

- Dose: 0.01-0.02 mg/kg (liquid/tablet)
- Not enough time – derm/neuro signs weeks to months to resolve
- Ensure compliance
- Rule out concurrent meds/diseases
- Use name brand or switch brands
- Give on empty stomach 1 hr before meal
- If on pill change to liquid
- Increase dose

# SUSPECT FELINE HYPERTHYROIDISM WITH: PALPABLE THYROID NODULE IN 80%

- Clinical signs

- Weight loss
- Polyphagia
- Pu/pd
- Hyperactivity
- Increased vocalization
- Vomiting/diarrhea
- Unkempt haircoat
- Tachycardia, tachypnea
- Apathetic <10% (lethargy, anorexia, dehydration, weakness)

- Hematology

- Erythrocytosis (mild)
- Lymphopenia, eosinopenia

- Biochemistry

- Increased ALT (>80%)
- Increased ALP (>50%)
- Azotemia ( $\approx$ 25%)

- Urinalysis

- Isosthenuria

# HYPERTHYROIDISM TESTING: KEEP IT SIMPLE

- Screen all cats >6 yr old whether signs or not
  - MCS may decrease (catabolism) without weight loss (polyphagia)
- TT4 (not FT4!) to screen
  - Usually only test necessary, increased in 90-95%
  - FT4 increased in 10-30% with nonthyroidal disease
- TT4 increased in clinical cat → diagnosis confirmed, treat
- TT4 increased in normal cat → retest 1 month, treat if still increased
- Borderline high TT4 → retest 1 month, or FT4 or TSH
- TT4 upper half normal range in cat >8-10 yr old → FT4 or TSH
- TT4 normal when suspect disease?
  - Repeat TT4, then FT4 (ED), TSH, last resort scintigraphy

# TSH FOR FELINE HYPERTHYROIDISM? YES! AND...

- Expected to be very low with hyperT<sub>4</sub>
- BUT
  - Canine TSH ≠ Feline TSH ≠ Human TSH
  - Feline TSH is closer to canine TSH (cTSH) than human TSH
  - Lower limit of detection of cTSH (0.03 ng/mL) is not low enough to differentiate between hyperT<sub>4</sub> cats and some normal cats



*J Vet Intern Med* 2015;29:1327–1334

## Evaluation of Serum Thyroid-Stimulating Hormone Concentration as a Diagnostic Test for Hyperthyroidism in Cats

M.E. Peterson, J.N. Guterl, R. Nichols, and M. Rishniw

- 917(!!) hyperT<sub>4</sub> cats, 32 suspected of HyperT<sub>4</sub>, and 131 normal
- Hyperthyroid cats
  - 98%--unmeasurably low TSH
- Euthyroid cats (suspects + normal)
  - 30%--unmeasurably low TSH
- Conclusion
  - Measurable TSH **usually** rules out hyperT<sub>4</sub>
  - (A newer assay with a lower cut-off is more specific--Truforma)

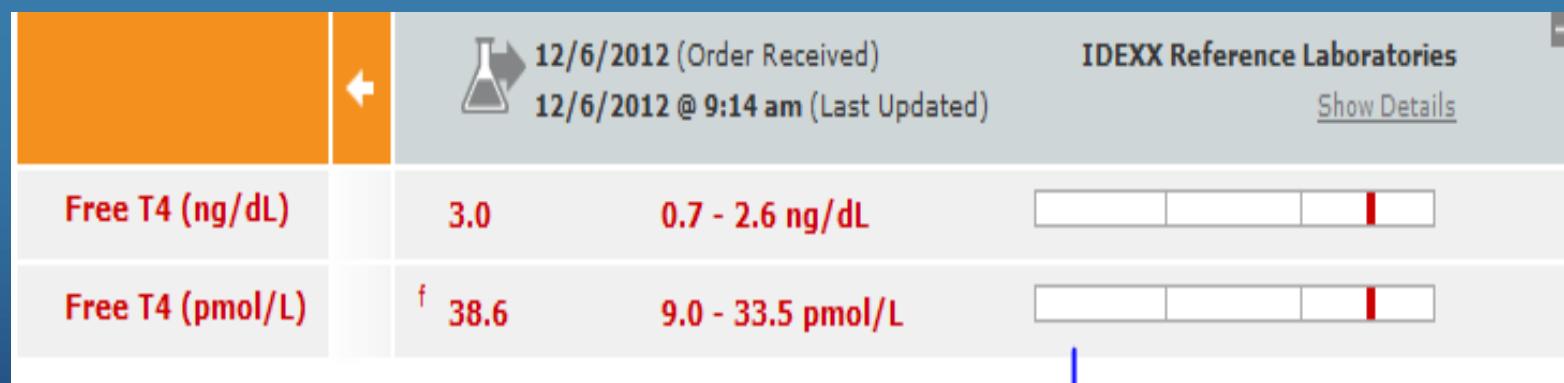
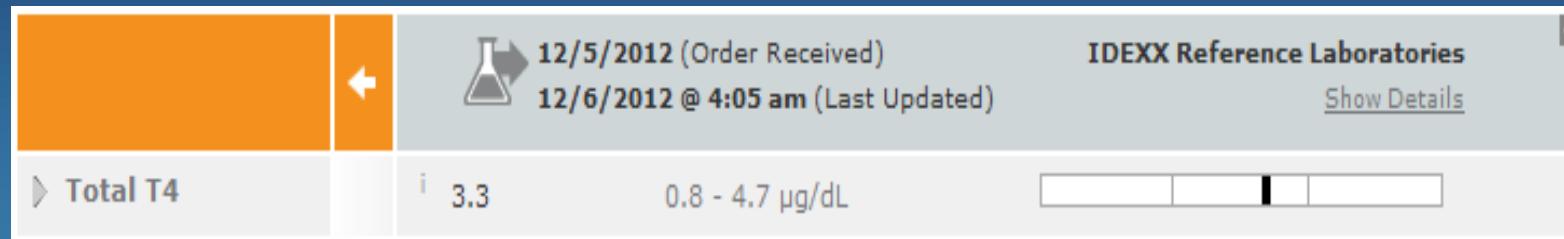
# MAYBE SOMETHING RE I131 PREP, PROTOCOL, POST TX MONITORING

- Prophylactic T4 sup to prevent transient iatro hypot4?
- When to monitor T4 post tx,
- If need to supplement T4 how to determine how long
- Impt to warn owners that some become permanently hypot4 and need lifelong supp (what if they chose I131 cuz impossible to pill?)

# **FELINE HYPERTHYROIDISM: DON'T FORGET**

- Importance of avoiding iatrogenic hypoT4
- Affect of non-thyroidal illness on freeT4
- Continue monitoring BP (at least 6 mo) if normal at diagnosis
- Treat adequately with CKD
- NTproBNP can differentiate thyrotoxic v primary cardiomyopathy
  - Should be normal 3 mo after euthyroid if thyrotoxic

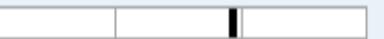
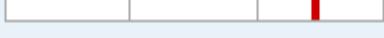
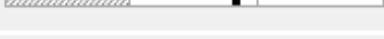
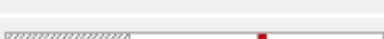
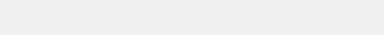
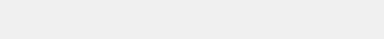
# 12-YR-OLD NM DOMESTIC SHORTHAIR CAT



# 1 MONTH RECHECK (METHIMAZOLE 2.5 MG BID)

		 1/11/2013 (Order Received) 1/11/2013 @ 2:28 pm (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>	 12/5/12
 Total T4	 0.7	0.8 - 4.7 µg/dL		 3.3

# 1 MONTH RECHECK (METHIMAZOLE 2.5 MG BID)

		1/11/2013 (Order Received) 1/11/2013 @ 2:28 pm (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>	12/5/12
► BUN	32	15 - 34 mg/dL		32
► Creatinine	1.8	0.8 - 2.3 mg/dL		1.5
► ALT	1,256	28 - 100 U/L		46
► AST	456	5 - 55 U/L		24
► ALP	49	0 - 62 U/L		22
► GGT	2	0 - 6 U/L		0
► Bilirubin - Total	0.9	0.0 - 0.4 mg/dL		0.1
► Bilirubin - Unconjugated	0.0	0 - 0.3 mg/dL		0.1
► Bilirubin - Conjugated	0.9	0.0 - 0.2 mg/dL		0.0

# **METHIMAZOLE SIDE EFFECTS**

- Most severe - hepatopathy and blood dyscrasias
- GI upset, facial pruritis, lethargy
- Not dose related
- First 4-6 weeks of therapy
- Less common after 2-3 months of treatment
- Rare
- How do you treat now?

# 5 WEEKS POST 131

	2/28/2013 (Order Received) 3/1/2013 @ 4:36 am (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>	1/21/13	1/15/13	1/11/13	12/5/12
▶ Total T4	<sup>e</sup> 0.5 0.8 - 4.7 µg/dL		<sup>f</sup> 3.7	<sup>g</sup> 2.4	<sup>h</sup> 0.7	<sup>i</sup> 3.3
▶ BUN	38 15 - 34 mg/dL		31	31	32	32
▶ Creatinine	2.6 0.8 - 2.3 mg/dL		1.6	1.5	1.8	1.5

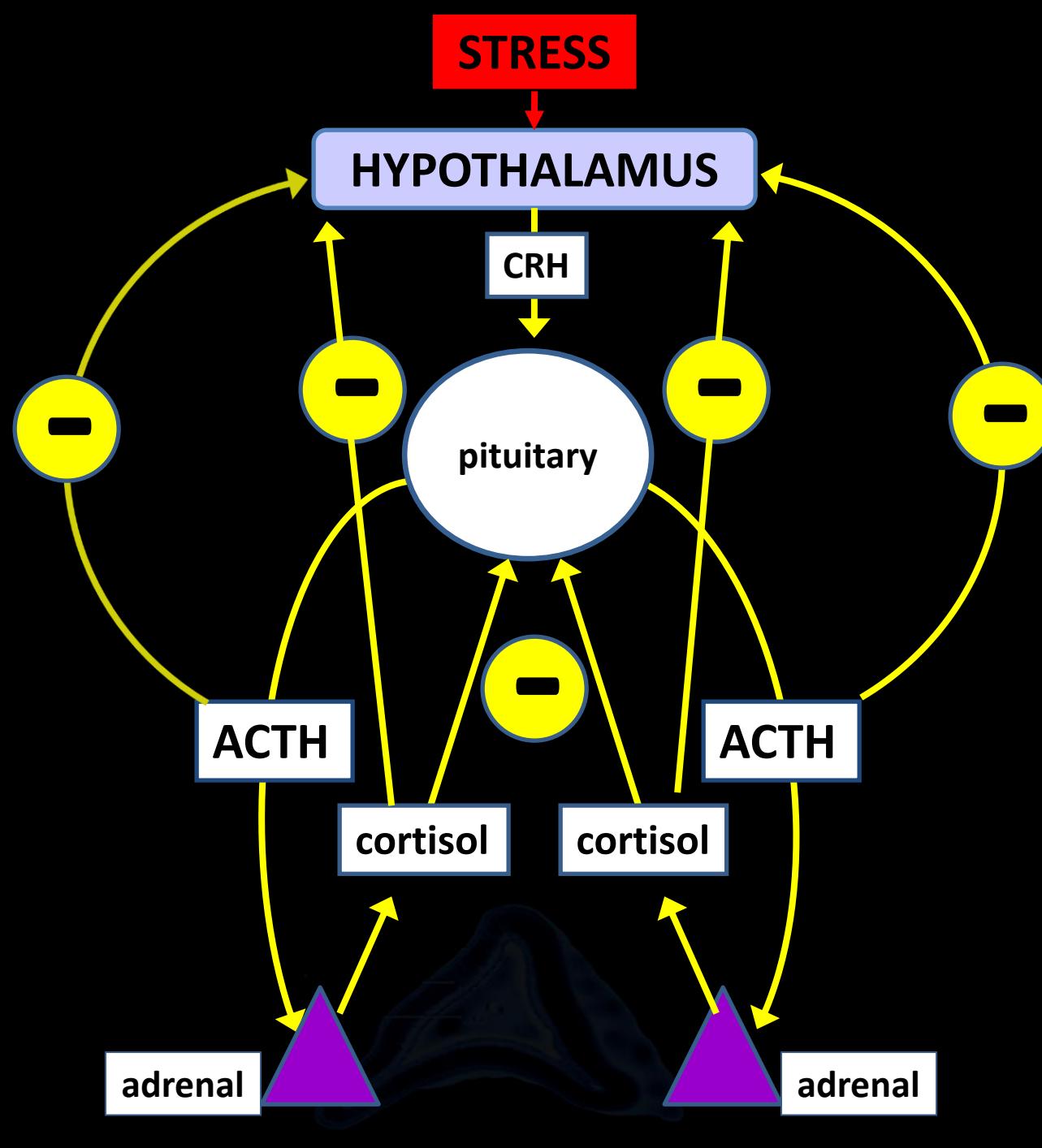
2 explanations for low T4?

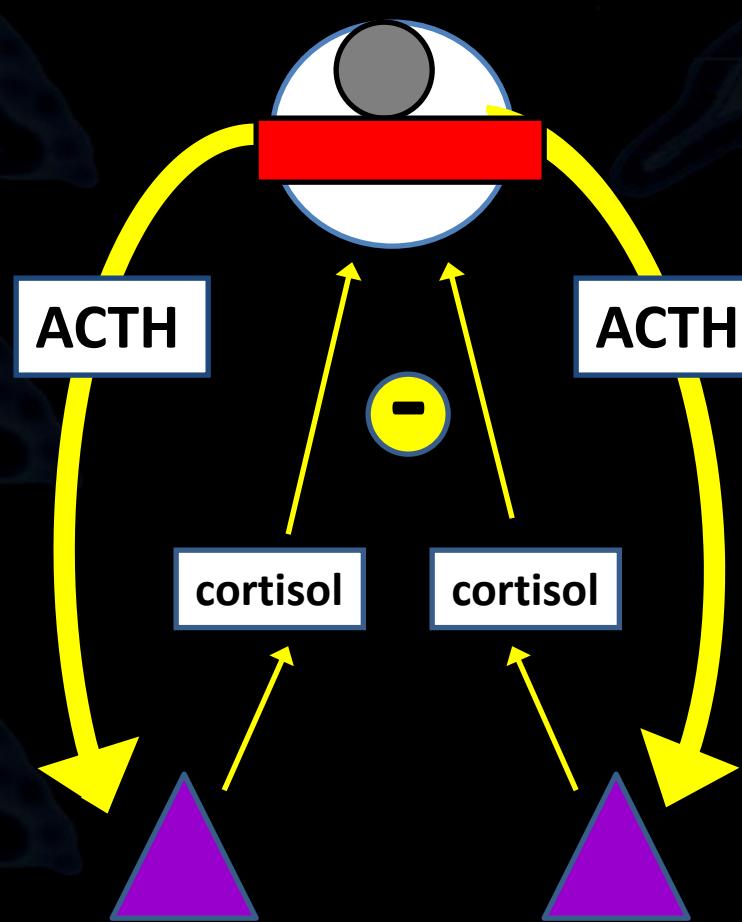
How to differentiate?

	3/1/2013 (Order Received) 3/1/2013 @ 11:20 am (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>	12/6/12
▶ Total T3	37 52 - 182 ng/dL		
▶ Free T4 (ng/dL)	<0.3 0.7 - 2.6 ng/dL		3.0
▶ Free T4 (pmol/L)	<sup>h</sup> <3.9 9.0 - 33.5 pmol/L		<sup>i</sup> 38.6
▶ cTSH	<sup>i</sup> >12.0 0.05 - 0.42 ng/mL		

**SYLVIA, STOP HERE!**

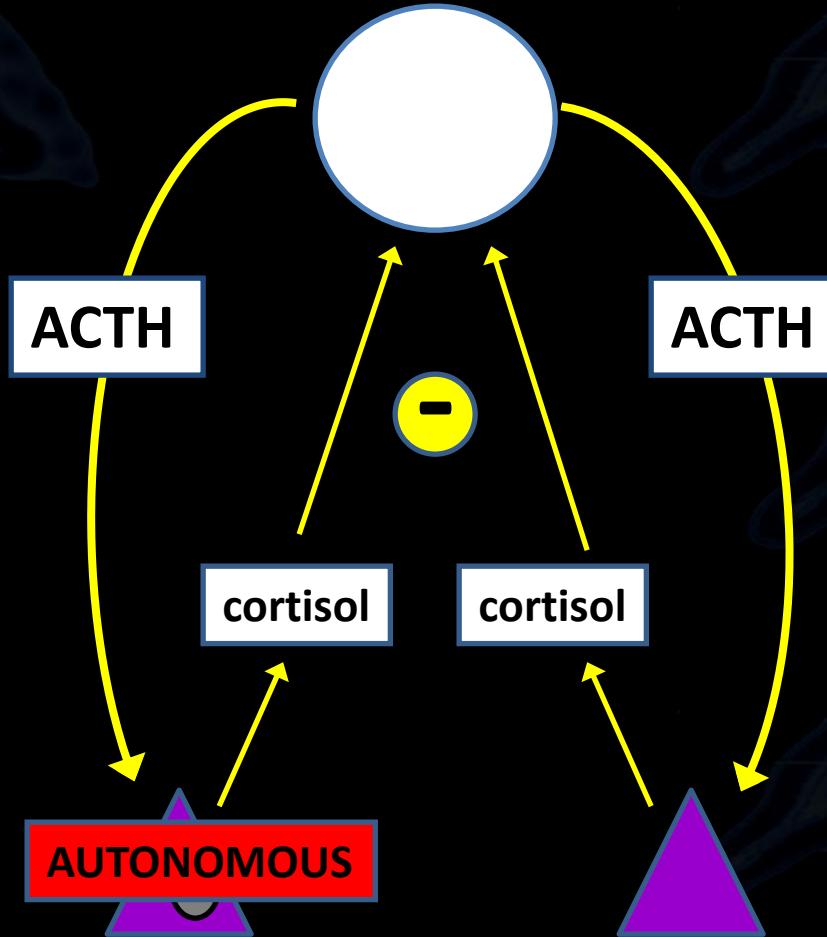
# TEST INTERPRETATION PRACTICE





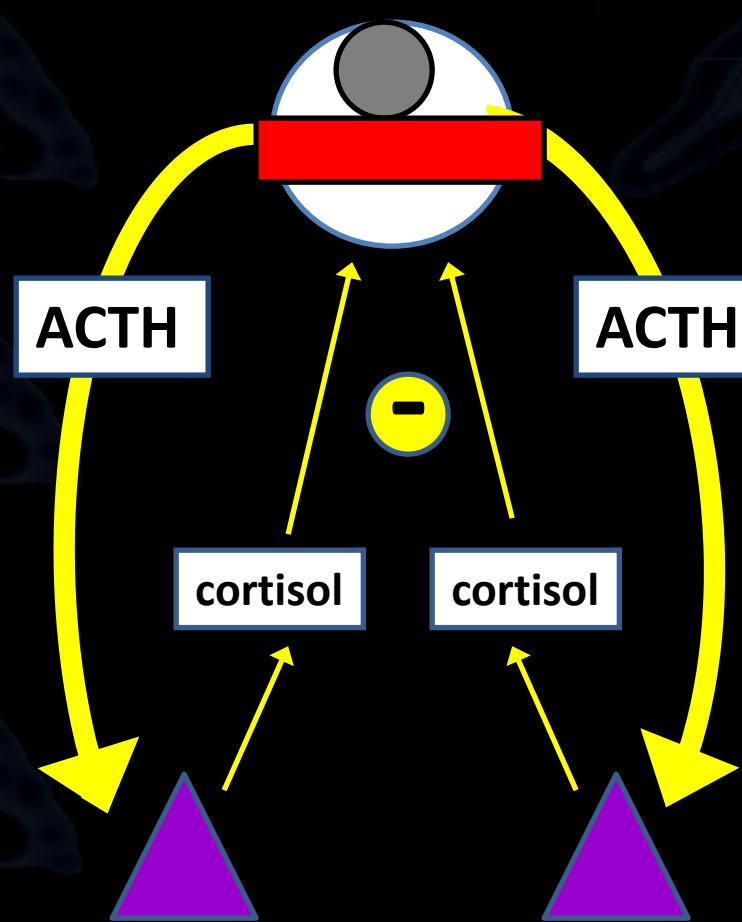
**Pituitary Tumor**

↑ ACTH  
Bilaterally ↑ adrenals  
↑ cortisol

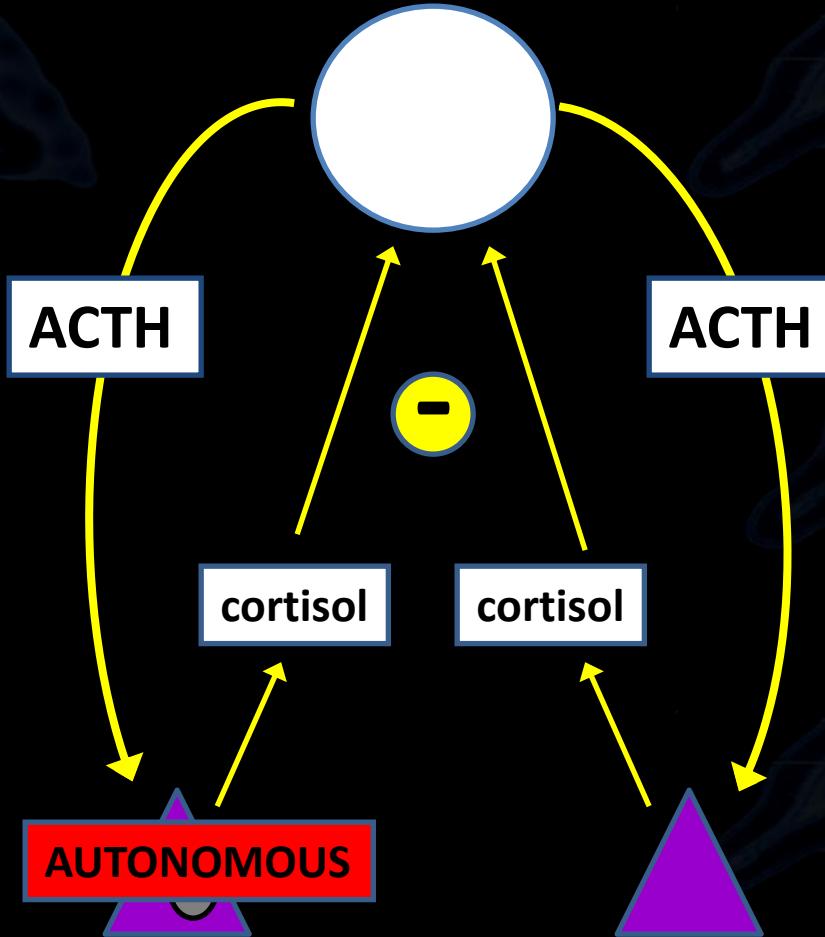


**Adrenal Tumor**

One ↑ ↑ adrenal  
↑ cortisol  
↓ ACTH

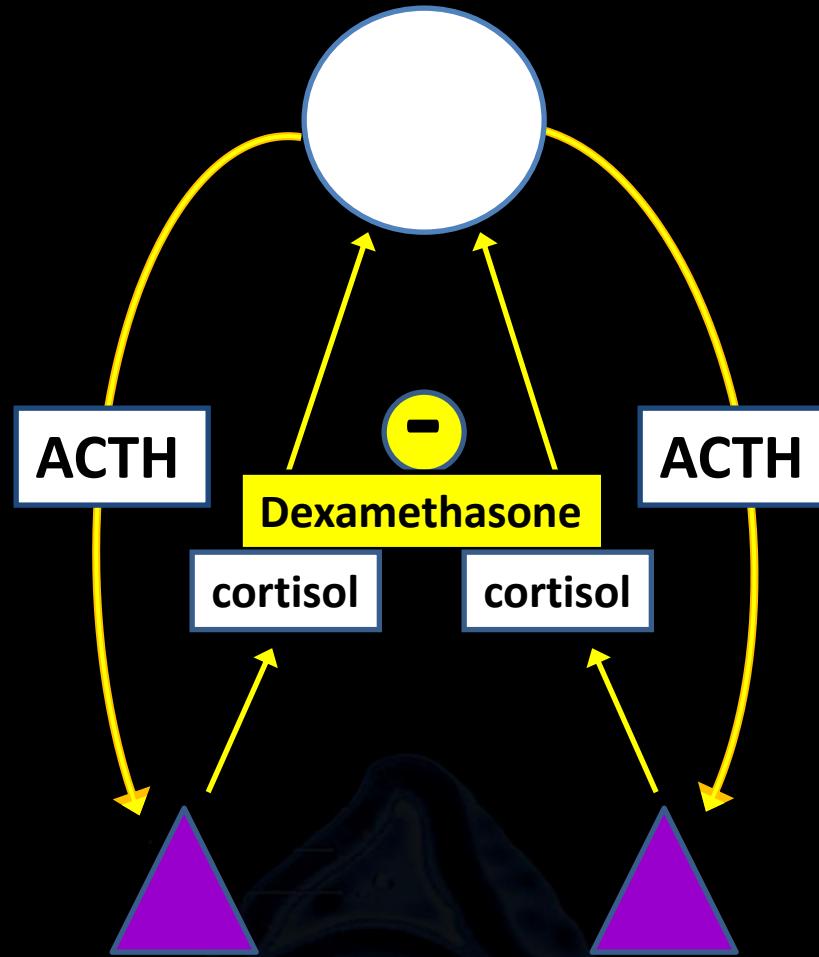


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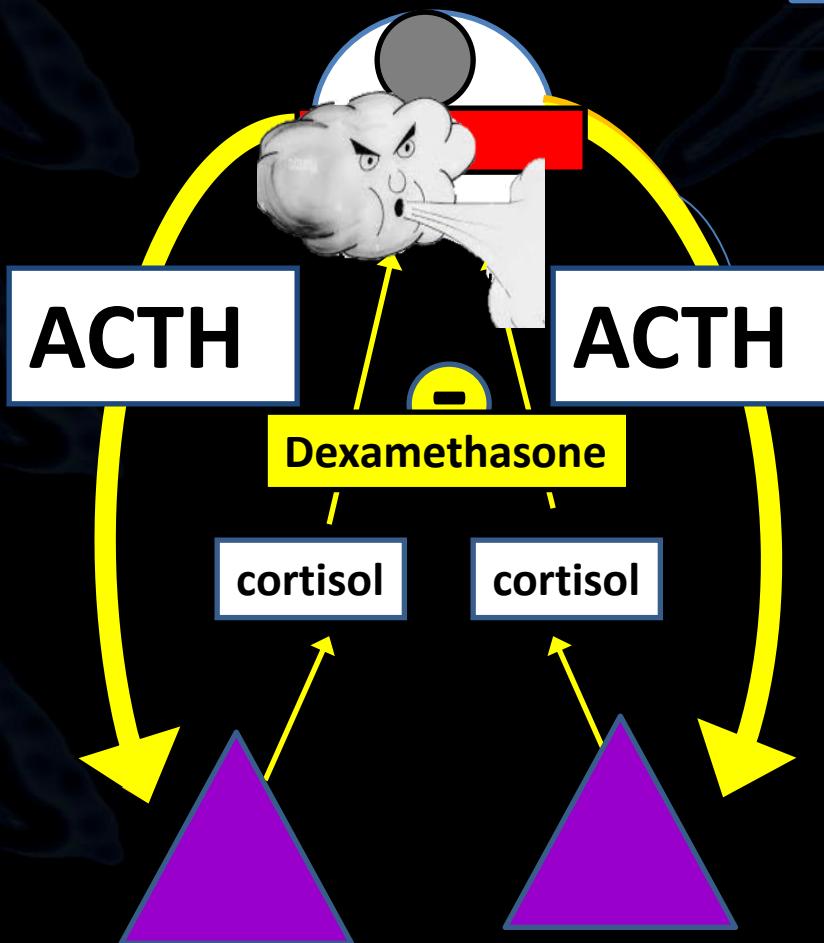


**Adrenal Tumor**  
One ↑ ↑ adrenal  
↑ cortisol  
↓ ACTH

# LDDDS: Normal Patient

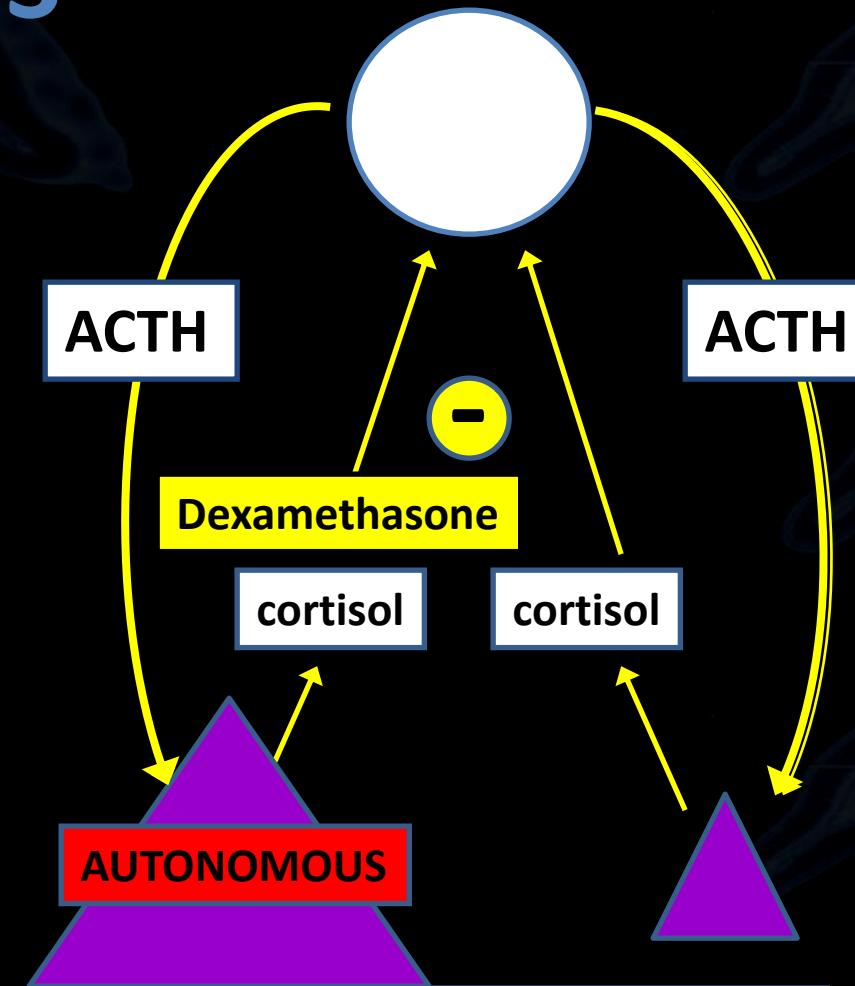


# LDDS



## Pituitary Tumor

↑ ACTH  
Bilaterally ↑ adrenals  
↑ cortisol



## Adrenal Tumor

One ↑ ↑ adrenal  
↑ cortisol  
↓ ACTH

**TINKERBELL**Canine | Chihuahua | Female | 11 y | [Profile](#) ▾[History](#) ▾ [Communication](#)2023 **Mar 16** [Mar 16](#) [Feb 14](#) 2022 [Nov 9](#) [Oct 5](#) **Sep 19** [Sep 19](#) [Sep 19](#) [Aug 17](#) [Feb 10](#) [Feb 10](#)[Result Details](#) ▾**Endocrinology**9/19/22  
8:45 PM**Cortisol - Baseline****11.8**

1.0 - 6.0 µg/dL

Cortisol - 4 hr Post  
Dex

1.4 µg/dL

Cortisol - 8 hr Post  
Dex

2.9 µg/dL

[!\[\]\(fb33b4c36e00be64c3a6d20a4dabb0a1\_img.jpg\)](#)  **CHARLIE**  
Canine | Poodle | Male | 13 y | [Profile](#) [+ History](#) [Communication](#)

2023 **Feb 7** [Jan 27](#) [Jan 27](#) 2022 [Dec 30](#) [Dec 14](#) [Dec 9](#) [Oct 31](#) [Oct 31](#) [Apr 20](#) [Apr 20](#) [Apr 20](#)

[Result Details](#) [!\[\]\(00eab258e83d0c1186d4489048e59d79\_img.jpg\)](#) [!\[\]\(a534b20221241d055d851336c490ccb3\_img.jpg\)](#) [!\[\]\(0f6cd9314f85de39f1304ea43a7ca011\_img.jpg\)](#) [!\[\]\(8884b535b054944f699722521f55acf7\_img.jpg\)](#) [!\[\]\(afe1a0a6196db6f795566d5f97daf6ff\_img.jpg\)](#) [!\[\]\(44367fb123306532986732859326fe74\_img.jpg\)](#)

Category	Date	Parameter	Value	Range	Unit
 <b>Endocrinology</b>	12/14/22 9:33 PM 				
 Cortisol - Baseline		4.0	1.0 - 6.0	µg/dL	
Cortisol - 4 hr Post Dex		1.8		µg/dL	
Cortisol - 8 hr Post Dex		1.9		µg/dL	

**GRACIE**Canine | Female | 15 y | [Profile](#) ▾[History](#) ▾[Communication](#)

2023

**Mar 16****Feb 23****Jan 17****Jan 6**

2022

**Dec 16****Dec 13****Dec 7****Dec 7****Mar 7****Feb 4**

202

Result Details ▾

**Endocrinology**12/16/22  
12:04 AM**Cortisol - Baseline****6.8**

1.0 - 6.0 µg/dL

Cortisol - 4 hr Post  
Dex

1.1

µg/dL

Cortisol - 8 hr Post  
Dex

4.2

µg/dL



# PERUA

Canine | Bichon Frise | Female | 12 y | [Profile](#)

2023 **Jan 24** 2022 **Dec 27** **Dec 16** **Dec 10**

[Result Details](#)

Category	Date	Value
 <b>Endocrinology</b>	12/27/22 1:15 AM	
 Cortisol - Baseline	a. 3.2	1.0 - 6.0 $\mu\text{g/dL}$
Cortisol - 4 hr Post Dex	b. 3.7	$\mu\text{g/dL}$
Cortisol - 8 hr Post Dex	c. 5.9	$\mu\text{g/dL}$

 [DecisionIQ](#)  [Graphing](#) 

[Expand All](#) | [Collapse All](#)

**Dexamethasone Suppression Interpretation**

0.01 mg/kg

Yes, clinical signs present

The result of the low dose dexamethasone suppression (LDDS) test in this dog **supports** a diagnosis of hyperadrenocorticism and **does not differentiate** pituitary-dependent from adrenal-dependent disease.

**NEXT STEP CONSIDERATIONS**

In a dog with clinical signs consistent with hyperadrenocorticism, it is recommended to pursue differentiation of pituitary-dependent from adrenal-dependent disease by performing either an abdominal ultrasound, high-dose dexamethasone suppression (HDDS) test, and/or an endogenous ACTH concentration. If the dog has concurrent illness (i.e. diabetes mellitus), consider first managing the concurrent disease and then repeating the LDDS prior to performing additional differentiating tests.

Please note that administration of exogenous steroids or stress related to concurrent illness may affect the results and interpretation of the dexamethasone suppression test.

Are you satisfied with this tool?  

**MOLLY**

09-4

Canine | Boxer | Female | 10 y | [Profile](#) ▾[History](#) ▾ [Communications](#)

2023

**Feb 18****Feb 11****Jan 24**

2022

**Sep 13****Aug 10****May 9****Feb 7****Jan 13**

2021

**Apr 5**

2020

[Result Details](#) ▾

 <b>Endocrinology</b>	1/24/23 9:26 PM 
 Cortisol - Baseline	a. 1.5  $1.0 - 6.0 \mu\text{g/dL}$
Cortisol - 4 hr Post Dex	b. 1.8 $\mu\text{g/dL}$
Cortisol - 8 hr Post Dex	c. 1.8 $\mu\text{g/dL}$

**RIPLEY**

Canine | CANINE,OTHER

Male

13 y

Profile ▾

History ▾ Comm

2023

**Jan 16****Jan 16**

2022

**Nov 2****Nov 2****Oct 19****Oct 4****Sep 10****Sep 10****Mar 17****Mar 1**

Result Details ▾

**Endocrinology**10/4/22  
10:57 PM

Cortisol - Baseline

a. 4.1

1.0 - 6.0 µg/dL

Cortisol - 4 hr Post  
Dex

b. 12.9

µg/dL

Cortisol - 8 hr Post  
Dex

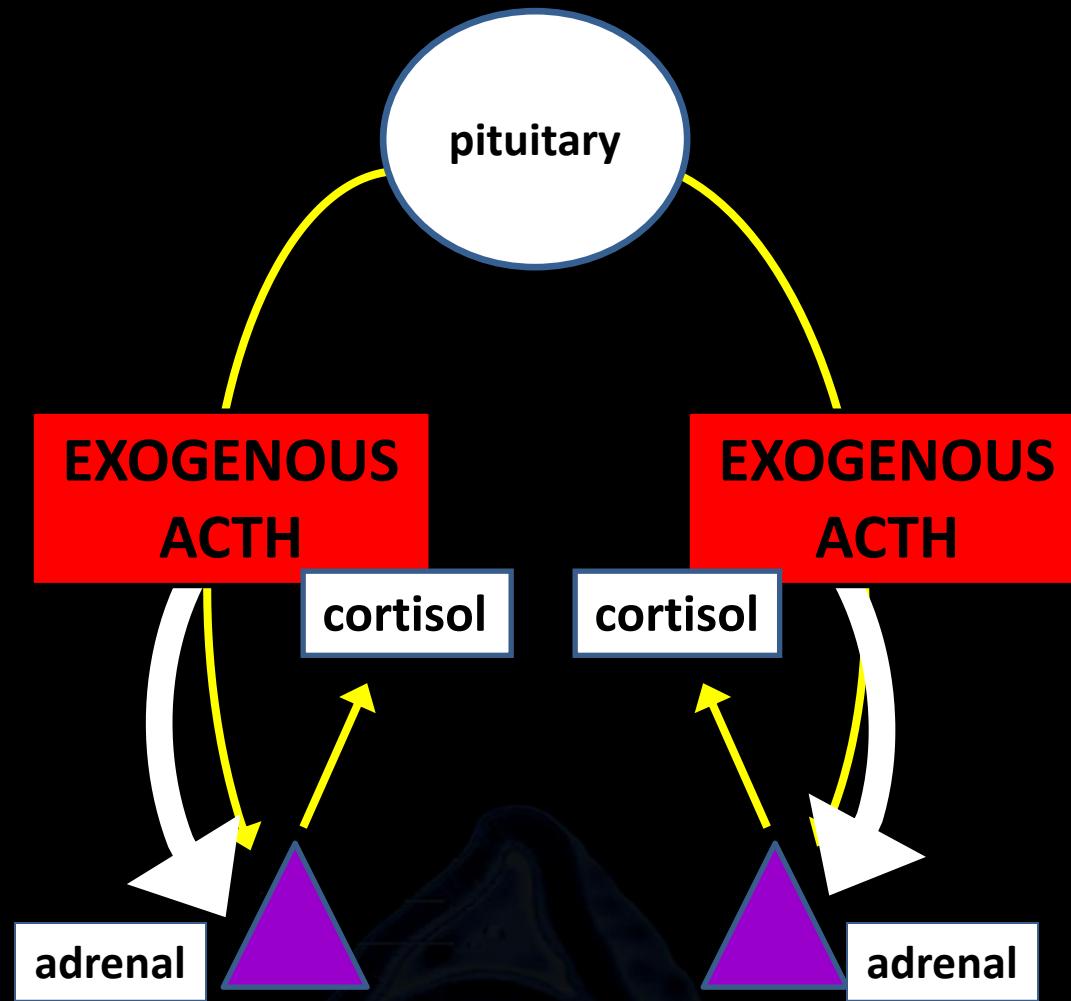
c. 5.7

µg/dL

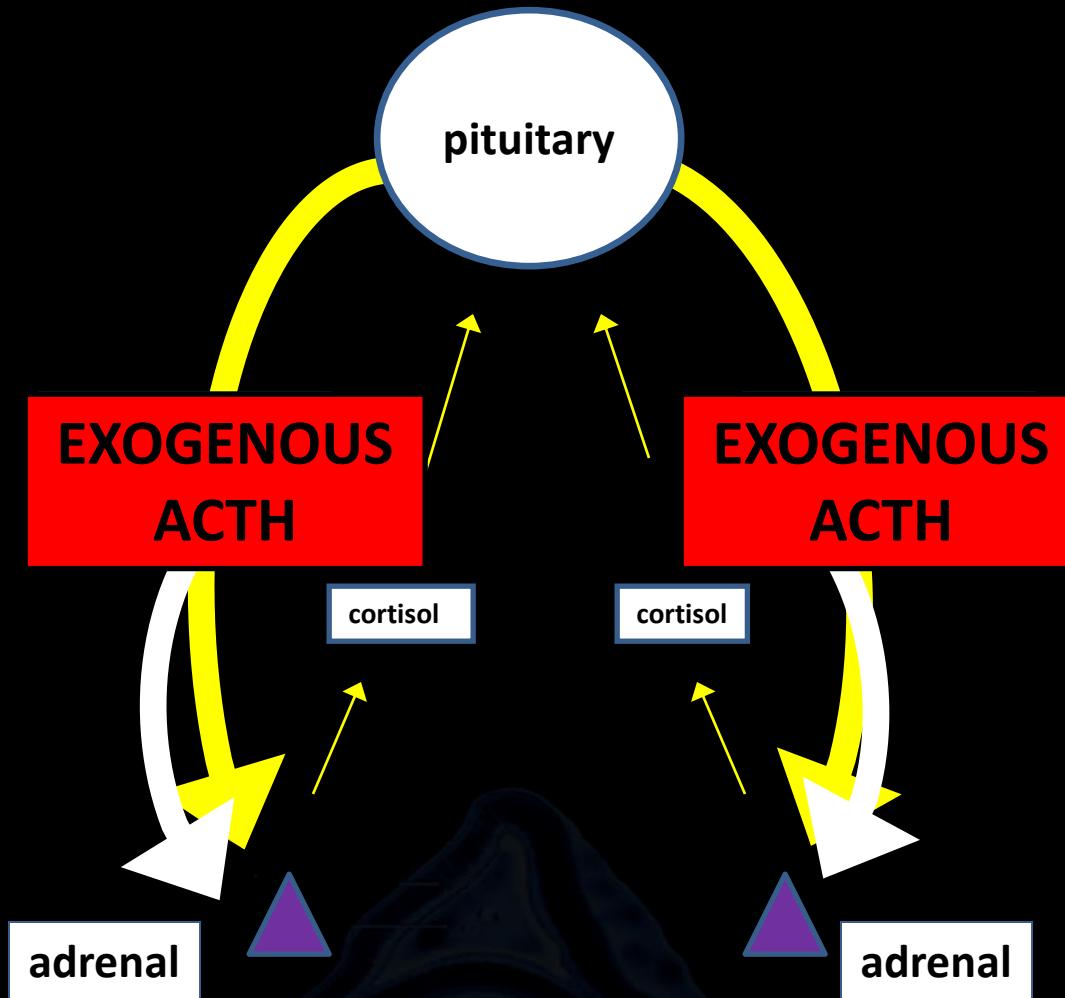
# HYPOADRENOCORTICISM

- Under screening dogs (slide of when to consider EEH)
- Confusion re resting cortisol – cut-off, need for stim
- Ignoring affect of exogenous roids on ACTH stim
- Confusion with borderline stims (they aren't addison's, prolly exog roids)
- Forgetting to monitor lytes if normal initially
- Treatment pearls...no specific pred dose (may need v little), DOCP keep it simple, for crisis LRs v 0.9% NaCl, etc.
- Confusion over monitoring in general

# ACTH Stimulation Test: Normal Dog



# ACTH Stimulation in an Addisonian



OOPS, THE POST-STIM CORTISOL IS BELOW REF RANGE—IS IT ADDISON'S?

# ACTH Stimulation Test Interpretation

- Post-sample:  $<2.0 \text{ } \mu\text{g/dL} (<55 \text{ } \text{nmol/L})$ 
  - Diagnostic of Hypo-AC
    - (IF no recent exposure to glucocorticoids)
  - Primary, Secondary, OR iatrogenic
- Post-sample:  $>2 \text{ } \mu\text{g/dL} (<55 \text{ } \text{nmol/L})$ 
  - NOT Addison's
- Post-sample:  $2.0 – 5.0 \text{ } \mu\text{g/dL} (55 – 138 \text{ } \text{nmol/L})$ 
  - Suspicious for steroid use in last month

# CONFIRM

 **Endocrinology** 7/3/15 1:38 AM 

Cortisol - Pre ACTH	<0.2	µg/dL
Cortisol - Post ACTH	a. <0.2	µg/dL

a. ACTH Reference Range:

Canine:	Feline	
2 - 6	0.5 - 5	Pre-ACTH (resting) cortisol
6 - 18	5 - 15	Post-ACTH cortisol
18 - 22	15 - 19	Equivocal post-ACTH cortisol
>22	>19	Post-ACTH cortisol consistent with hyperadrenocorticism
<2	<0.5	Post-ACTH cortisol consistent with hypoadrenocorticism
1 - 5	n/a	Desired pre- and post-ACTH cortisol on lysodren therapy

ACTH response test is only clearly positive (>22) in 30% of dogs with hyperadrenocorticism (HAC); equivocally positive in another 30% of dogs with HAC, and normal in 40 % of dogs with HAC.\* If the ACTH response test is normal and HAC is still suspected, proceed with a low-dose dexamethasone suppression test.

Dogs with iatrogenic Cushing's disease will have flatline response test results in the low end or below the normal reference range.

Both HAC and hypoadrenocorticism are rare diseases in cats.

\*Reference: Feldman and Nelson: Canine and Feline Endocrinology and Reproduction. 3rd ed. W.B.Saunders Co., 2004.

## **WHAT IF STIM RESULTS ARE BORDERLINE? (POST ACTH CORTISOL 3-5ISH...)**

These are tricky...

# A retrospective study of dogs with atypical hypoadrenocorticism: a diagnostic cut-off or continuum?

J. A. WAKAYAMA<sup>1</sup>, E. FURROW, L. K. MERKEL AND P. J. ARMSTRONG

- 9 dogs with stim results > 2 µg/dL (3.4 – 8.1 µg/dL)
  - “Equivocal”
  - Follow-up median 24 months (10-77 months)
  - 2 dogs lost to follow-up
  - 3 dogs were clinically well after d/c'd pred <sup>65</sup>
  - 4 dogs—no improvement with pred
  - **THESE DOGS DIDN'T HAVE ADDISON'S!!!**

OOPS, BASELINE CORTISOL IS LOW, CAN I TREAT  
NOW?

# Baseline cortisol

Premise:

Dogs with hypoadrenocorticism should have very minimal (or no) baseline cortisol production. If the baseline cortisol is above a given concentration (2-3 µg/dL; 55 – 83 nmol/L), the dog does NOT have hypoadrenocorticism.

**CAN ONLY RULE-OUT HYPOADRENOCORTICISM!**

# Baseline Cortisol: Clinical Use



**CANNOT DIAGNOSE HYPOADRENOCORTICISM WITH A  
BASELINE CORTISOL CONCENTRATION.**



## Rule-out Hypo-AC

- Baseline  $>2.0 \mu\text{g/dL}$  (55 nmol/L), Hypo-AC very unlikely
- If  $< 2.0 \mu\text{g/dL}$ , need to run ACTH-stim test

Less expensive

Non-critical patients (time)



**DOES EVERY SICK DOG HAVE EEH?  
(ADDISON'S AKA THE GREAT PRETENDER.)**

**Right?**

# EEH IS INDISTINGUISHABLE FROM CHRONIC GI DISEASE

- 2 studies of dogs with chronic GI disease, resting cortisol <2 → ACTH stim
  - 4% final diagnosis hypoadrenocorticism (Hauck, et al. JVIM 2020)
  - 0.34% in a later study (Gallego, et al. JVIM 2022)
- Uncommon but life changing
- Repeat resting cortisol if first <2 µg/mL?
  - Repeat was normal in 67% with first < 2 µg/mL (Gallego, et al. JVIM 2022)

## SUSPECT EEH WHEN:

- **Gastrointestinal signs**
  - **Megaesophagus?**
- **Albumin: globulin <1.08**
  - Over 1/3 hyperglobulinemic
  - **Hypoalbuminemia more common w EEH**
- **Low cholesterol (<3.43 mmol/L)**
- **Lack of stress leukogram in sick animal**
  - **Lymphocyte count >1500–1750 cells/ $\mu$ L**
  - **Eosinophil count >500 cells/ $\mu$ L**
- **Reticulocytosis without anemia**
- **Increasing Ca, decreasing BG, regurgitation...**

EEH in 30-40% of Addisonian dogs  
Cats get it too.

EEH dogs older (8 yr) at dx than dogs with 'regular' Addison's (5 yr)...

OOPS, THE DOG WAS SCREAMING ADDISON'S,  
AND I GAVE STEROIDS BEFORE THE ACTH  
STIMULATION TEST. CAN I INTERPRET IT?

Probably...

# GLUCOCORTICOIDS IMPACT ACTH STIM TEST IN 2 WAYS:

- Cross-react with cortisol assay
  - Prednisone, prednisolone, methylprednisolone, etc.
  - NOT dexamethasone
- Suppress HPA Axis
  - Stim okay after single dose of dexamethasone (adrenal crisis)
  - Discontinue exogenous glucocorticoids minimum 2-3 wk before ACTH stim
    - All types – oral, topical otic/ocular, human skin creams
  - If signs occur as taper okay to perform stim
  - Post ACTH cortisol 2-8 µg/dL common, if stable repeat ACTH stim 2-3 wk



# Questions?



# CONFLICT OF INTEREST DISCLOSURE:

I have financial interest, arrangement or affiliation with:

- Company A: Employee, honorarium, grant, consultant, own stock, etc.
- Company B: Employee, honorarium, grant, consultant, own stock, etc.
- Company C: Employee, honorarium, grant, consultant, own stock, etc.
- Company D: Employee, honorarium, grant, consultant, own stock, etc.

# **WHAT FLUID SHOULD I USE TO TREAT AN ADRENAL CRISIS?**

Good old LRs.

# ADRENAL CRISIS: RETHINKING INITIAL FLUID CHOICE

- LRs advantages
  - Contains buffer
  - $\text{Na}^+$  concentration lower than 0.9% NaCl
    - Lowest of isotonic crystalloids, 130 mEq/L
  - Trivial K (and Ca) concentration
- 0.9% NaCl concerns
  - Higher  $\text{Na}^+$  concentration may raise serum Na too fast
    - Osmotic demyelination syndrome
  - Acidifying
  - Renal vasoconstriction due to high  $\text{Cl}^-$  concentration

# EMERGENCY TREATMENT

- IV fluids
  - 10-20 ml/kg bolus (5-10 ml/kg cat) over 15-30 min, reassess, repeat prn
- IV dexamethasone
  - 0.1-0.2 mg/kg IV then 0.05 mg/kg q12h for 24-72 h
  - No prednis(ol)one or hydrocortisone until ACTH stim completed
  - No advantage to hydrocortisone CRI v dexamethasone injections
- Dextrose if hypoglycemic
  - 1 gm/kg 50% dextrose diluted 1:4 then add 2.5-5.0% to fluids
- Blood products if severe anemia (GI bleed)
- Remember whipworms → pseudohypoaldrenocorticism

# MAINTENANCE TREATMENT IS LIFELONG

## Prednisone

- 0.1–0.2 mg/kg/day
  - OFTEN LOWER
  - E.g., 0.03 mg/kg/day lg dogs
- 0.5 mg/kg initially
- 2–10X dose during stress or illness

## DOCP (NEVER sole treatment)

- 1.1 mg/kg SQ/IM q28 days
- DOCP has no glucocorticoid activity
- Decrease dose 10–15% if hypokalemia or hypernatremia

## Monitor

- Electrolytes at 14 days, then 28 days, eventually q3–6 months
- CBC, biochemical panel, urinalysis at least yearly once stable

# HUMAN DOSE ADJUSTMENT GUIDELINES...

Adrenal Insufficiency Patient Guide to Management of Illness and Stress-Related Medical Events			
Updated 8/31/2020			
	Event	Sub-Event	Dosage Recommendation*
Home Self-management	Illness with fever	Fever >100.4-102°F	Double hydrocortisone replacement dose until recovery (~2-3 days)
		Fever >102.2°F	Triple hydrocortisone replacement dose until recovery (~2-3 days)
	Circumstantial increased physical and/or emotional stress	Unusual work-related stress or increased hours, travel, overexertion, intensive exercise, positive or negative emotional stress	Dependent on individual and circumstance, but typically requires extra dose of 5-10 mg based on symptoms; proactively consult with endocrinologist at routine visit
	Dental work	Any	Extra hydrocortisone 10-20 mg can be given a few hours later depending on pain level from procedure
		Local anesthesia	Extra hydrocortisone 20 mg before procedure
Healthcare Practitioner Administered	Unable to tolerate oral medications due to illness or trauma		Hydrocortisone 100 mg IM or SC and consider ER; see NADF Guide to Adrenal Crisis Care Medication Information
	Minor to moderate surgery stress		Hydrocortisone 25-75 mg per 24 hours in addition to maintenance dose (~1-2 days)
	Dental work	General anesthesia	Extra hydrocortisone 50 mg IV before anesthesia
	Unable to tolerate oral medications due to illness or trauma	With dehydration or inability/unwillingness to self-inject IM or SC	Hydrocortisone 100 mg IV
	Major surgery or major stress from severe infection, sepsis (hospitalized)		Hydrocortisone 100 mg IV and continuous infusion 200 mg/24 hours
Other	Cardiac stress test or angiogram	Consult your endocrinologist	
	Colonoscopy		
	Chemotherapy		

# **DO I NEED TO USE DOCP IF ELECTROLYTES ARE NORMAL?**

Probably not at least initially but...

## Evaluation of Aldosterone Concentrations in Dogs with Hypoadrenocorticism

M.E. Baumstark, N.S. Sieber-Ruckstuhl, C. Müller, M. Wenger, F.S. Boretti, and C.E. Reusch

- **Normal electrolytes does not mean normal aldosterone**
- **4/70 dogs with HA were atypical**
  - 3/70: Na<sup>+</sup> and K<sup>+</sup> within reference range
  - 1/70: K<sup>+</sup> decreased
  - **ACTH-stimulated aldosterone undetectable in all**
  - **BUT do they need DOCP???**
    - Perform aldosterone stimulation test?
- **1 developed hyperkalemia 6 months later**
- **(Another study: Approx 10% will develop e-lyte abnormalities and require mineralocorticoid...)**

# IS HYPOADRENOCORTICISM A THING IN CATS?

Rare but in the news lately.

STANDARD ARTICLE

Open Access



## Clinical findings, treatment, and outcomes in cats with naturally occurring hypoadrenocorticism: 41 cases

Emma Roberts Ian K. Ramsey, Ruth Gostelow, Anna Latysheva, Luca Battaglia, Paolo Silvestrini, Ghita Benchekroun, Karen Brenner, Bérénice Conversy, Riccardo Ferriani ... See all authors

First published: 11 December 2024 | <https://doi.org/10.1111/jvim.17243>

## Hypoadrenocorticism in cats: a 40-year update

Magdalena J Glebocka and Alisdair Boag

*Journal of Feline Medicine and Surgery*

1–7

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STANDARD ARTICLE

Journal of Veterinary Internal Medicine



American College of Veterinary Internal Medicine

Open Access

## Clinical features and long-term management of cats with primary hypoadrenocorticism using desoxycorticosterone pivalate and prednisolone

Nadja S. Sieber-Ruckstuhl<sup>1</sup> | Livia Harburger<sup>1</sup> | Natalie Hofer<sup>1</sup> |

Claudia Kümmelre<sup>1</sup> | Claudia Müller<sup>1</sup> | Barbara Riond<sup>2</sup> |

Regina Hofmann-Lehmann<sup>2</sup> | Claudia E. Reusch<sup>1</sup> | Felicitas S. Boretti<sup>1</sup>

# HYPOADRENOCORTICISM CAT STYLE...

- Autoimmune, trauma, lymphoma, congenital (2 cats <12 mo)
- Clinical signs and lab findings like dogs (lack of stress leukogram)
- Hypercalcemia in 32% (iCa)
- EEH exists in cats (some zero aldosterone pre-, post stim)
- Low cobalamin, low TLI (EPI) in some
- ACTH stim 5 µg /kg, **125 µg/cat IV, IM**, 30- and 60-min post samples
- Treatment similar to dog but caution re volume overload
- DOCP dose 2.2 mg/kg (higher than dog)
- Pred dose median 0.3 mg/kg

# YOU CANNOT CORRECT HYPOKALEMIA IN A CAT NO MATTER HOW MUCH K GLUCONATE YOU GIVE

- PHA under-recognized
- When to suspect
- How to differentiate from CKD (phos, alkalosis, CK, etc)
- Treatment – does medical ever work

# PRIMARY HYPERALDOSTERONISM

- **Most common feline adrenal disease**
- **Hypokalemia, hypertension**
- **Progressive renal / cardiac damage due to aldosterone AT1 receptor effects**
- **Unilateral adrenal carcinoma or adenoma most common**
- **Diagnosis → adrenal mass, ↑ basal aldosterone + hypokalemia usually sufficient**
- **Treatment**
  - **Surgery → adrenalectomy curative**
  - **Medical → spironolactone 2 mg/kg q12h, amlodipine 0.1–0.2 mg/kg q24 h, K gluconate 1–6 mEq/cat q12h**

# IF ↑ BP AND ↓ K IS NOT DUE TO CKD OR HYPERTHYROIDISM... DON'T FORGET ABOUT PRIMARY HYPERALDOSTERONISM.

- Hypertension, hypokalemia
- Cardiac (and renal) changes due to aldosterone AG1 receptors
- Unilateral adrenal carcinoma / adenoma most common
- Diagnosis → adrenal mass, increased aldosterone with hypokalemia
  - Alkalosis not acidosis
  - Phosphorous normal or low not high
- Treatment
  - Surgery → adrenalectomy
  - Medical → spironolactone 2 mg/kg q12h, amlodipine 0.1-0.2 mg/kg q24 h, K gluconate 1-6 mEq/cat q12h

} vs CKD

# IS IT PHA OR CKD?

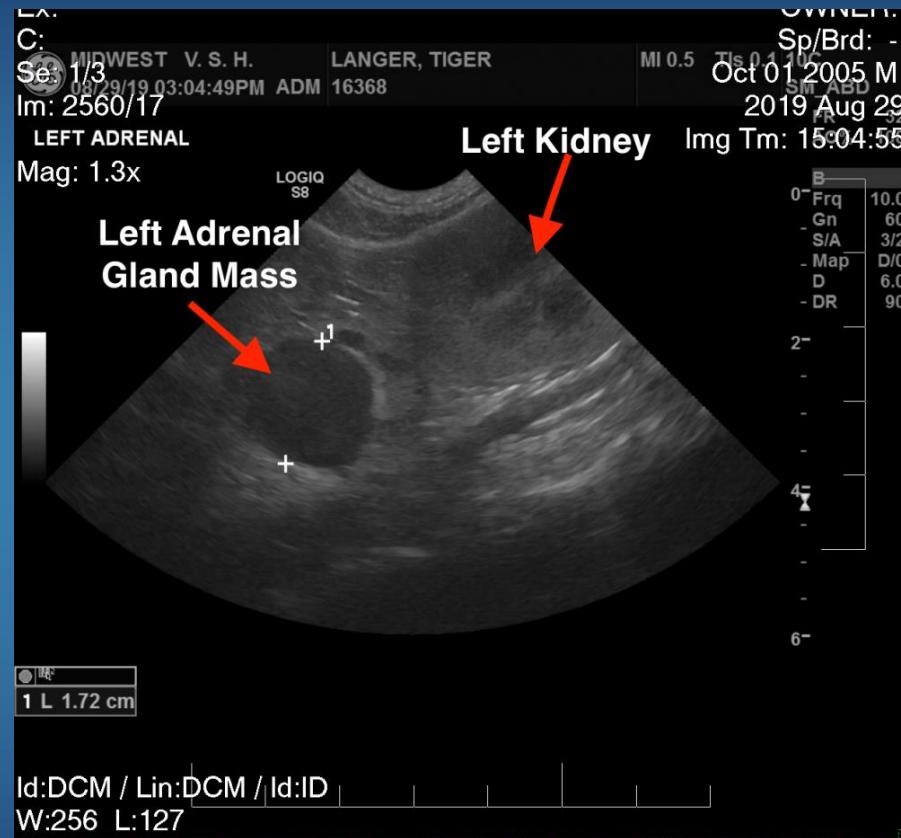
- PHA more likely if:
  - Phosphorous normal or low
  - Metabolic alkalosis
  - Increased CK
  - Hypertension and hypokalemia disproportionate to degree of azotemia
    - Hypokalemia unresponsive to oral potassium supplementation is a clue
  - Adrenal mass vs small irregular kidneys on abdominal ultrasound

PHA and CKD can co-exist. Maintain awareness.

## Chemistry

1/24/22  
10:20 AM1/10/22  
8:50 AM1/7/22  
2:38 PM1/6/22  
12:14 PM

Glucose	119	149		
Sodium	160	162	162	164
Potassium	2.7	2.9	2.9	2.6
Na: K Ratio	58	55	56	62
Chloride	112	117	118	118
Total Protein	9.0	9.1		
Albumin	3.7	3.6		
Globulin	5.3	5.5		
Albumin: Globulin Ratio	0.7	0.7		
ALT	109	81		
ALP	<10	32		
GGT	1	1		
Bilirubin - Total	0.9	0.4		
Cholesterol	166	154		
Amylase	1,048	966		
Lipase	1,950	2,268		





Diagnostic result printed 2/2/2022 3:47 PM

[Details >](#)



Endocrinology

1/25/22  
4:47 AM



Aldosterone

a. 1,846 pmol/L

a. Reference Ranges: Canine Feline  
Pre: 14-957 194-388 pmol/L  
Post: 197-2103 277-721 pmol/L

Referral test performed at Michigan State University.

This concentration of aldosterone is markedly elevated. The magnitude of this elevation suggests that an aldosterone secreting adrenocortical tumor is the likely cause. Some adrenal tumors associated with pronounced elevations of aldosterone may also have clinically significant increases of other intermediate steroids in the mineralocorticoid pathway. Alopecia, thinning skin, hyperglycemia and diabetes mellitus have been reported in cats with adrenal tumors secreting excesses of both aldosterone and progesterone.

# HYPOGLYCEMIA – INSULINOMA?

- Not considering/ruling out more common causes
- Clues – v low glucose, dog should be seizing, looks normal...
- When to draw sample for insulin:glucose (fasting glucose curve...)
- Paying attention to amended ratio
- Test interpretation tips
- Treatment tips – feed v IV dextrose, medical if sx not possible, etc

# HYPERCALCEMIA

- Importance of iCa – when is it really necessary
- Clues – calcium scary high, dog looks normal
- Ruling out other causes
- Interpreting iCa, PTH panel
- Over reliance on PTHrp results
- Emergency treatment for ‘malignant’ (v high) Ca

# CONFLICT OF INTEREST DISCLOSURE

I have no relevant financial interest, arrangement or affiliation with any company or organization.

# TRIAGE/PRIMARY SURVEY: ENDOCRINE?

- A - airway
- B - breathing
- C - circulation
- D – disability (neuro)
- E – exposure/exsanguination

# EMERGENCY LABS

- PCV/TS
- Blood glucose
- Lactate
- Electrolytes
- CBC, biochemistry, UA



The 'Big 4' immediately

# LABORATORY CLUES TO ENDOCRINE DISEASE

## MULTIPLE CHANGES INCREASES ODDS

- CBC

HCT ↑ or ↓

Lack of stress  
leukogram

Lymph >1500/uL

Eos > 500/uL

Thrombocytosis

- Biochemical profile

Glucose ↑ or ↓

Na:K ratio ↓

Calcium ↑ or ↓

ALP increased

Chol and alb ↓

T4 ↑ or ↓

- Urinalysis

USG ↓

Glucosuria

Ketonuria

Proteinuria

UTI

# IN CLINIC ENDOCRINE TESTING: NICE TO HAVE...

- Cortisol
  - >2 excludes hypoadrenocorticism
  - <2 requires ACTH stim to confirm
- Ketones (beta hydroxybutyrate)
  - Major ketone produced
  - Appears in blood before urine – earlier detection
- T4
  - Hyperthyroidism in cats
  - Myxedema coma (NOT ‘standard’ hypoT4) in dogs
- Fructosamine
  - Rule out stress hyperglycemia
  - Support for chronic hypoglycemia

# IS HYPOGLYCEMIA ENDOCRINE?

- Other more common causes ruled out?
- Insulin overdose ruled out?
- Hypoadrenocorticism → resting cortisol
- Insulinoma → insulin:glucose panel
  - Middle-aged to older large breed
  - BG <60 mg/dL (<50 mg/dL?)
  - Fasting glucose curve if necessary
  - Serum v glucometer
  - If BG on panel comes back >60 mg/dL cannot interpret

Episodic (hunting/small breeds)  
Hypoadrenocorticism  
Iatrogenic (insulin overdose)  
Insulinoma  
Juvenile (fasting)  
Liver disease  
Paraneoplastic  
Sepsis  
Xylitol

# INSULIN OVERDOSE

- Diagnosis straight forward (or is it Patty? Like maybe same dose given but pet lost weight, changed activity, blah blah)
- Risk higher w
  - Cats (v dogs), cats on  $>6$  U insulin/dose, inappetance, vomiting post insulin, obesity
- Dextrose IV or feed based on severity of signs
  - 0.5-1 ml/kg 50% dextrose, diluted 1:2-1:4 over 5 minutes, 2.5-5% dextrose in fluids
  - Small amount food q4-6h (Patty diet preference or what to avoid, simple carbs etc)
- Oral glucose (Karo syrup, honey) by owner or if IV access difficult/delayed
  - Effectiveness may require swallowing part of dose
- Duration of hypoglycemia hours to days - not related to type or dose of insulin
- Restart insulin whenever Dr. Lathan tells us to...
  - $\frac{1}{4}$  to  $\frac{1}{2}$  prior dose ?
  - Indication for CBGM?

# IS HYPERKALEMIA ENDOCRINE?

- You're sure it's hypoadrenocorticism but resting cortisol 12
- Pseudohyperkalemia?
- Urinary system intact?
- Whipworms?
- Pleural, peritoneal, pericardial effusion?

# DIABETIC EMERGENCIES

DKA IN CATS HAS GOTTEN A LITTLE TRICKIER...

# EUGLYCEMIC DKA IN CATS ON SGLT2 INHIBITORS.

- Ketosis, acidosis, BG <250 mg/dl (sometimes much lower)
  - If blood gas not available ketosis with normal BG sufficient
- Highest risk within 1<sup>st</sup> 2 weeks of starting drug (86%)
- No hyperglycemia due to increased renal loss and depleted glycogen stores
- Some insulin (Type 2 DM) but not enough to prevent ketosis
- Ketosis = another disease
  - CBC, biochemistry, UA, pancreatic lipase, retroviral screen to identify
- Use ketone meter for earlier detection of ketones (beta-hydroxybutyrate)
  - Urine dipstick (acetoacetate) fine if all you have

*Clinically no different from 'standard' DKA – awareness is key to diagnosis.*

*Consider with euglycemia, mild hyperglycemia, or mild hyperglycemia...*

# TREATMENT: GENERAL

- Stop SGLT2 inhibitor
- Correct fluid, acid-base, electrolyte abnormalities
- Insulin
- Dextrose
- Identify and treat precipitating factor
  - Pancreatitis, infection, hyperthyroidism...(add / subtract from list)

# INSULIN TO STOP KETOSIS EVEN THOUGH BG NORMAL

- Regular insulin as soon as  $K \geq 3.3$  mEq/L (Do they have to wait?)
  - 0.05-0.1 U/kg/hr (studies on alternative protocols complete?)
- Dextrose immediately
  - 0.25-0.5 ml/kg 50% dextrose bolus, diluted 1:2-1:4
  - 5-10% dextrose added to fluids
- Monitor BG q1-2 h til stable, then q 4-6 h (change timing if want)
- Switch to long-acting insulin when ketosis resolved, eating – 4-7 days usually
  - Provide early (w/in 48 hr) enteral nutritional support
- Insulin required for life

# FLUIDS: WHICH, HOW MUCH, HOW FAST

- Isotonic balanced crystalloid with normal pH (7.4)
  - Normosol-R, Plasma-Lyte A, pHLyte
- Correct hypovolemia within 30-60 minutes
  - Bolus 15-20 ml/kg dog, 5-10 ml/kg cat over 15-30 minutes, repeat prn
- Correct dehydration over 6-24 hr
  - BW (kg) x percent dehydration (as decimal) x 1000 = ml to administer
- Keep up with ongoing losses and provide maintenance
- Supplement K to maintain serum K  $\geq 3.3$  mEq/L
  - Phosphorous and magnesium supplementation if indicated (uncommon)
- NaHCO<sub>3</sub> if HCO<sub>3</sub><sup>-</sup> < 8 mmol/L, pH < 7.1 (uncommon)
- Monitor body weight 2-4x/d and avoid volume overload
  - 5% increase → consider adjusting
  - 10% increase → volume overload

# HYPEROSMOLAR HYPERGLYCEMIC STATE (HHS)

- BG >600 mg/dL
  - Vicious cycle of osmotic diuresis/free water loss → hyperglycemia → osmotic diuresis...
  - Reduced GFR required for nd exacerbates severe hyperglycemia
- Osmolarity >320 mOsm/kg dog, >350 mOsm/kg cat
  - CNS parenchymal dehydration → neuro signs (obtundation, seizures, blindness...)
  - *Effective osmolality = 2[Na<sup>+</sup>] + [glucose (mg/dl) ÷ 18]*
  - PAY ATTENTION TO THE SODIUM!!!!
- pH >7.3 arterial, pH >7.2 venous, bicarb >15 mmol/L
- No or minimal ketones
  - Usually enough insulin to prevent ketosis but not hyperglycemia
- Cats v dogs if important and any other “Patty Pearls”

# HHS TREATMENT

- Correct fluid deficit
- Correct hyperglycemia slowly
- Correct and maintain normal electrolytes
- Address concurrent illness
  - Infection, pancreatitis, metabolic, GI, CHF

# FLUID THERAPY FOR HHS

- **Correct deficits prior to insulin**
  - Fluid losses twice that of DKA in humans
  - Avoid rapid reduction BG (max decrease 50-75 mg/dl/h) and Na (<0.5-1 mEq/K/h)
- **Normosol R or Plasma-Lyte 148 (higher Na-containing balanced crystalloid)**
  - $\text{Corrected Na} = \text{Na}^+ \text{ (serum)} + 1.6 \times (\text{measured glucose} - 100) \div 100$
  - Supplement K (and Phos, Mg prn)
- **Regular insulin non-ketotic HHS when**
  - Hypovolemia corrected and dehydration (mostly) corrected
  - BG plateaued or decrease of <50 gm/dL/h
- **Regular insulin ketotic HHS when (Patty...)**

# HHS REGULAR INSULIN THERAPY

- **Intermittent IM**
  - 0.1 U/kg then 0.05 U/kg q2-4h
- **CRI**
  - 1-2 U/kg in 250 ml 0.9%NaCl start at 10 ml/hr
- **Monitor blood glucose q2h**
  - Decrease not to exceed 50-75 mg/dL/h
  - Decrease insulin dose 25-50% +/- dextrose if more rapid decline

BG (mg/dL)	ml /h	% dextrose
>300	10	None
250-300	7	2.5
200-249	5	2.5
100-100	5	5

# ADRENAL EMERGENCIES

**WHAT FLUID SHOULD I USE IN AN ADRENAL CRISIS?**

# ADRENAL CRISIS: THE PROBLEM WITH 0.9% NaCl

- LR's advantages
  - Contains buffer
  - Na concentration lower than 0.9% NaCl
  - Trivial K concentration
- 0.9% NaCl concerns
  - Acidifying (no buffer, Cl metabolic acid)
  - Higher Na concentration may raise serum Na too fast
    - Especially when Na <130 mEq/L
    - Osmotic demyelination syndrome
  - Renal vasoconstriction due to high Cl concentration

# ADRENAL CRISIS TREATMENT

- IV fluids
  - 10–20 ml/kg bolus over 15–30 min, reassess, repeat prn
- IV dexamethasone
  - 0.1–0.2 mg/kg IV then 0.05 mg/kg q12h for 24-72h
  - No prednis(ol)one or hydrocortisone until ACTH stim completed
  - No advantage to hydrocortisone CRI v dexamethasone injections
- Dextrose if hypoglycemic
  - 1 gm/kg 50% dextrose diluted 1:4 then add 2.5–5.0% to fluids
- Blood products if severe anemia (GI bleed)
- (Don't forget about whipworms!)

# MAINTENANCE TREATMENT IS LIFELONG

## Prednisone

- 0.1–0.2 mg/kg/day
  - OFTEN LOWER
  - E.g., 0.03 mg/kg/day lg dogs
- 0.5 mg/kg initially
- 2–10X dose during stress or illness

## DOCP (NEVER sole treatment)

- 1.1 mg/kg SQ/IM q28 days
- DOCP has no glucocorticoid activity
- Decrease dose 10–15% if hypokalemia or hypernatremia

## Monitor

- Electrolytes at 14 days, then 28 days, eventually q3–6 months
- CBC, biochemical panel, urinalysis at least yearly once stable

# THYROID EMERGENCIES

Heads up—Brooklyn is doing some open mouth breathing here. Doesn't seem dyspneic. Minimal B lines. Giving torb. HR 276. Injection is supposed to be at 1 and can't get in touch with owner. I really think this is the thyroid. So we're gonna give some atenolol and move forward with treatment unless you have a gut feeling that owner would rather delay and do a cardio consult. I really think he needs his thyroid to stabilize.

I think owners would trust your judgement for sure. I'll try to call him also.

Thank you!

My call was forwarded :(

He says proceed with I 131

Brilliant—thank you!!!

+ iMessage



Wed, Dec 17 at 2:17 PM



# Treatment

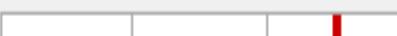
- Atenolol: 6.25-12.5 mg/cat q 12 h
- (and tx for hyperT4)



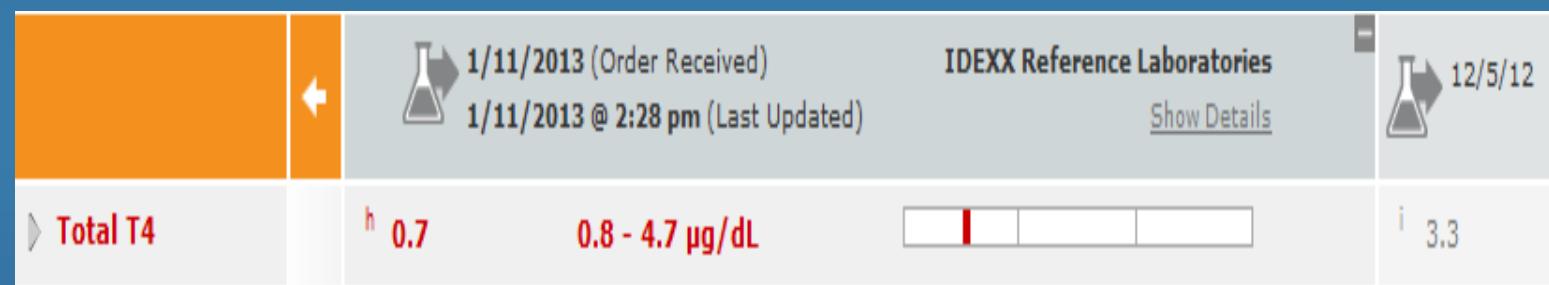


# 12-YR-OLD NM DOMESTIC SHORTHAIR CAT

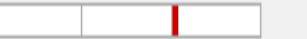
	 12/5/2012 (Order Received) 12/6/2012 @ 4:05 am (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>
► Total T4	3.3 0.8 - 4.7 µg/dL	

	 12/6/2012 (Order Received) 12/6/2012 @ 9:14 am (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>
Free T4 (ng/dL)	3.0 0.7 - 2.6 ng/dL	
Free T4 (pmol/L)	38.6 9.0 - 33.5 pmol/L	

# 1 MONTH RECHECK T4 (METHIMAZOLE 2.5 MG BID)



# 5 WEEKS POST <sup>131</sup>I

	 2/28/2013 (Order Received) 3/1/2013 @ 4:36 am (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>	 1/21/13	 1/15/13	 1/11/13	 12/5/12
▶ Total T4	<sup>e</sup> 0.5 0.8 - 4.7 µg/dL		<sup>f</sup> 3.7	<sup>g</sup> 2.4	<sup>h</sup> 0.7	<sup>i</sup> 3.3
▶ BUN	38 15 - 34 mg/dL		31	31	32	32
▶ Creatinine	2.6 0.8 - 2.3 mg/dL		1.6	1.5	1.8	1.5

2 explanations for low T4?

How to differentiate?

	 3/1/2013 (Order Received) 3/1/2013 @ 11:20 am (Last Updated)	IDEXX Reference Laboratories <a href="#">Show Details</a>	 12/6/12
▶ Total T3	37 52 - 182 ng/dL		
▶ Free T4 (ng/dL)	<0.3 0.7 - 2.6 ng/dL		3.0
▶ Free T4 (pmol/L)	<sup>h</sup> <3.9 9.0 - 33.5 pmol/L		<sup>i</sup> 38.6
▶ cTSH	<sup>i</sup> >12.0 0.05 - 0.42 ng/mL		

# FELINE HYPERTHYROIDISM TREATMENT

- Radioiodine ( $^{131}\text{I}$ )
  - Eliminates benign tumors, hyperplastic tissue, extrathyroidal tissue with single treatment (cure)
- Methimazole
  - 2.5 mg/cat PO q12h (lower dose if azotemic at diagnosis)
  - Dose adjusted to T4 at/below middle of reference interval
    - If concurrent CKD target T4 slightly higher *but still within reference interval*
    - Adverse effects usually within 1<sup>st</sup> 3 months
      - GI, blood dyscrasias, facial excoriation
- Iodine-restricted diet (Hill's y/d)
  - T4 within reference interval in 75% at 8 weeks, remains upper limit in majority
- Surgery (cure)



















# CONFLICT OF INTEREST DISCLOSURE

I have financial interest, arrangement or affiliation with:

- Company A: Employee, honorarium, grant, consultant, own stock, etc.
- Company B: Employee, honorarium, grant, consultant, own stock, etc.
- Company C: Employee, honorarium, grant, consultant, own stock, etc.
- Company D: Employee, honorarium, grant, consultant, own stock, etc.





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# THANK YOU

DON'T FORGET TO RATE YOUR SPEAKER  
AND SESSION IN THE APP!

Presented By

**NAVC**  
YOUR VETERINARY COMMUNITY

