Endocrine Disorders of Cats and Dogs – Part 1
Endocrine vs Exocrine

- Endocrine glands produce HORMONES, these are secreted directly into the blood stream.
- Exocrine glands secrete chemicals outside the organ they operate in (i.e., sweat glands in Skin, pancreatic digestive enzymes from Pancreas).
Hypothalamus and Pituitary
Hypothalamus and Pituitary

Hypothalamic Control of Posterior Pituitary

- Paraventricular nucleus (ADH)
- Supraoptic nucleus (Oxy)
- Optic chiasma
- Hypothalamus
- Infundibulum
- Hypothalamo-hypophyseal tract
- Anterior pituitary
- Posterior pituitary

ADH and oxytocin produced here
ADH and oxytocin released
Vasopressin / Anti Diuretic Hormone

Osmoreceptors detect increased osmotic pressure

Baroreceptors (aortic arch, carotid sinus) detect decreased blood pressure

Hypothalamic neuron

Posterior pituitary

ADH

Blood vessel

Vasoconstriction

Kidney

Increased reabsorption of water

Increased blood volume

Increased blood pressure
The Renal Nephron

- Glomerulus
- Bowman's capsule
- Proximal Convoluted Tubule
- Distal Convoluted Tubule
- Collecting Duct
- Vasa recta
- Loop of Henle

ADH
ADH

A diuretic is an agent that increases the rate of urine formation. **ANTIURETIC** hormone conserves body water by **REDUCING** the **LOSS OF WATER IN URINE**.

Injection of small amounts of antidiuretic hormone into an animal results in antidiuresis or **DECREASED** formation of urine.

Antidiuretic hormone binds to receptors on cells in the collecting ducts of the kidney and promotes reabsorption of water back into the circulation. **WITHOUT** antidiuretic hormone, the collecting ducts are virtually **IMPERMEABLE TO WATER, AND IT FLOWS OUT AS DILUTE URINE**.
(a) ADH present: Collecting duct is highly permeable to water.
ADH

ADH = Anti Diuretic Hormone

- Stop Diuresis
- More Concentrated Urine
- Less Water Lost in urine
- More Water Retained in circulation

**WITH ADH** ➔ HYDRATED

**WITHOUT ADH** ➔ DEHYDRATION
Polydysia / Polyuria

- Poly = many / much
- Dypsia = drinking
- Uria = urinating

Many endocrine disorders cause POLYDIPSIA + POLYURIA

1) either directly through increased THIRST

2) or indirectly by causing dilution of urine (diuresis) → DEHYDRATION → THIRST
Diabetes Insipidus

- Primary - disorder of hypothalamus/pituitary
  - = Central D.I. (ADH deficiency)
- Secondary - disorder of nephron
  - = Renal or Acquired Nephrogenic D.I.
- Other - Psychogenic Polydipsia

**DRINK/URINATE +++++**
- Drink > 100mls/Kg/Day
- Urinate >50mls/Kg/Day
Nephrogenic Diabetes Insipidus

Paraventricular Nucleus
Supraoptic Nucleus
Posterior Pituitary

ADH

Collecting Duct

Dilute Urine
Central D.I.

- USG 1.001-1.0120
- RARE
- Due to head injury, tumor or disease process that affects hypothalamus or pituitary
Acquired Neprogenic D.I.

- USG 1.008-1.016
- COMMON
- Symptoms of Kidney Disease
  - ++++ Protein in urine
  - +++ WBC in urine
  - +/- Bacteria in the urine
  - +++ BUN, Creatinine
Psychogenic Polydipsia

- USG 1.003-1.023
- Common
- Kidneys normal function
- Good news, you dog is not going to die!
- May have Renal Washout

(Not able to concentrate urine due to loss of solute in renal medulla)
Renal Wash Out

Diagram showing the renal wash out process with the following components:
- Cortex
- Distal tubule
- Outer medulla
- Inner medulla
- Collecting duct
- Loop of Henle

Key elements:
- Water ($H_2O$)
- Sodium chloride (NaCl)
- Urea
- Water (Water)
Disorders of Growth Hormone

Growth Hormone is produced by cells in the Anterior Pituitary.

Can have too much - Acromegaly (Cats)

Or too little - Dwarfism (Dogs/Cats)
Hypothalamus and Pituitary

Hypothalamic Control of Posterior Pituitary

Paraventricular nucleus (ADH)
Supraoptic nucleus (Oxy)
Optic chiasma
Hypothalamus
Infundibulum
Hypothalamo-hypophyseal tract
Anterior pituitary

Growth Hormone

ADH and oxytocin produced here
ADH and oxytocin released
Growth Hormone

Anterior Pituitary

acts on
Carbohydrates
Protein
Lipids

Control
Growth of skeletal system and viscera
Acromegaly

Too Much Growth Hormone

- Rare
- Big Head
- Big Feet
- Big CAT!
- Older cats
- Often D.M.
Dwarfism

- Deficiency of G.H.
- Rare
- Congenital Disease or Pituitary Gland Damaged
- No Treatment
Parathyroid Glands
Hyperparathyroid diseases

- Disorder of Para Thyroid Hormone - PTH
- Primary (functional tumor of PT gland) RARE
- Secondary (chronic renal failure) COMMON
- Cancer (Some cancers can produce a PTH like protein that mimics hyperparathyroid disease)

HYPERCALCAEMIA +++Ca
Also changes in PHOSPHATE metabolism, either ↑↓
PLEASE PREPARE YOURSELVES
Primary Hyperparathyroidism

- The signs and symptoms of primary hyperparathyroidism are those of hypercalcemia.

Bone
- Resorption; calcium and phosphorus released to blood

Kidney
- Increased calcium reabsorption
- Increased phosphate excretion

Intestine
- Activation of vitamin D
- Increased calcium uptake by intestinal mucosa

Calcium increases
Secondary Renal Hyperparathyroidism

Phosphorus and calcium continue to be released from bone

Increased bone resorption

Increased PTH synthesis and secretion

Both Calcium and Phosphate increase
Hypercalcemia and Hypophosphatemia
Hypoparathyroid Diseases

- Rare in dogs and cats
- Often man made = iatrogenic
- (surgery to remove thyroid glands in cats)
- Causes Low calcium, high phosphorus
Thyroid Diseases

Grumpy Cats!!!!
Thyroid Diseases

Sleepy dogs!
Thyroid Disorders

- Cats get
  - HYPERthyroid

- Dogs get
  - HYPOthyroid
Thyroid Glands
Feline Hyperthyroid Disease

- Very Common
- Affects cats >8y mostly
- Wt loss, +++Appetite
- Hyperactive, behavior change
- Palpate enlarged Thyroid
- 70% of time both glands
- Secondary heart disease
- common, also hypertension
- Hyperplasia, adenoma, carcinoma
Feline Hyperthyroid Disease

- **DIAGNOSIS**
  - blood test for total T4 (thyroxine)
  - The higher the T4, the worse the disease

- **TREATMENTS**
  - Antithyroid drugs for life
  - Radioactive iodine (available??)
  - Thyroidectomy (watch out for parathyroids)
Canine Hypothyroid Disease

- Common
- Middle age dogs
- Wt gain, Lethargy, Depressed
- Skin changes, - MANY.
- Hair loss, thinning of coat
- Weak (sometimes),
- Reduced reproductive ability.
- Anemia
- High Cholesterol
Canine Hypothyroid Disease

Primary
• Caused by progressive destruction of thyroid gland, gets worse over time
• Normal hard to diagnose
• Easy to treat

Secondary
• Any disease that makes dog unwell can cause
• low thyroid hormone (sick thyroid syndrome, or euthyroid sick syndrome)
Clinical Manifestations of Hypothyroidism in the Adult Dog

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<th>Metabolic</th>
<th>Dermatologic</th>
<th>Ocular</th>
<th>Cardiovascular</th>
<th>Gastrointestinal</th>
<th>Hematologic</th>
<th>Neuromuscular</th>
<th>Behavior Abnormalities</th>
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<td>Endocrine alopecia*</td>
<td>Corneal lipid deposits</td>
<td>Decreased contractility</td>
<td>Esophageal hypomotility*</td>
<td>Anemia*</td>
<td>Weakness*</td>
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<td>Symmetric or asymmetric</td>
<td>Corneal ulceration</td>
<td>Bradycardia</td>
<td>Diarrhea</td>
<td>Hyperlipidemia*</td>
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* Common.
Canine Hypothyroid Disease

- Hard to diagnose because many diseases can look like hypothyroid
- Also many disease can cause low thyroxine (T4)

To DIAGNOSIS….

1) Symptoms + Blood tests for thyroxine levels (total T4, and free T4)
2) TSH test (thyroid stimulating hormone), to help distinguish between Hypothyroid, and Sick thyroid syndrome
3) Observe a response to treatment
TSH – Thyroid Stimulating Hormone

- When T4 low, no suppression of hypothalamus (TRH) or Pituitary (TSH)
- Hypothyroid dogs should have low T4, and HIGH TRH/TSH
- Test for ↑ TSH
Hypothyroid

- Treatment easy
- Give Thyroxine daily
- Can use Medication trial to help diagnose HypoT
- Response to medication often dramatic
- Happy Dogs!!
Habis