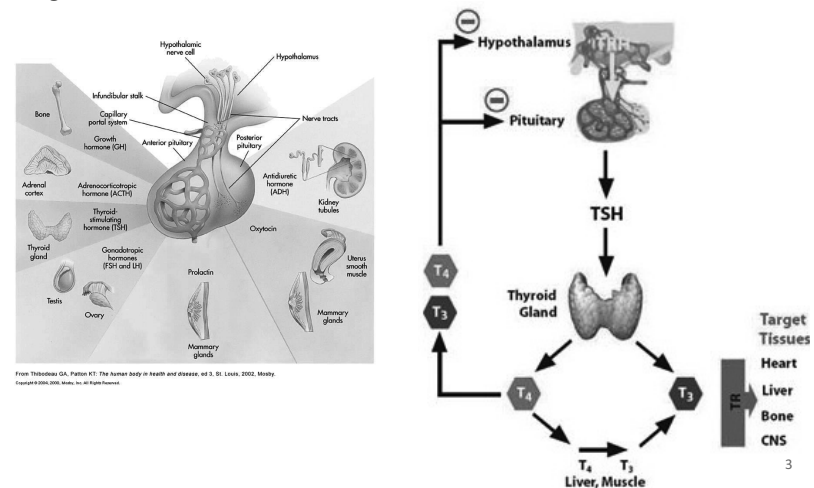




老年貓咪最常見
內分泌疾病
甲狀腺機能亢進全攻略

台中艾利動物醫院
主治獸醫師 林辰柔

Hypothalamic-Pituitary-Thyroid Gland Axis



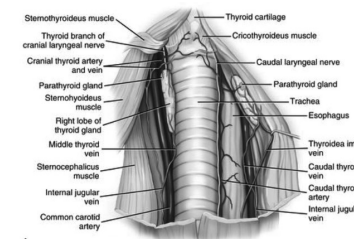
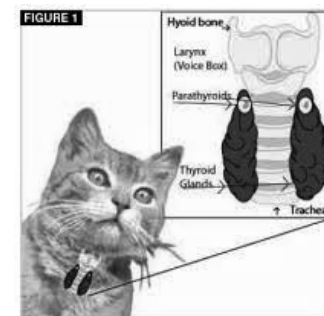
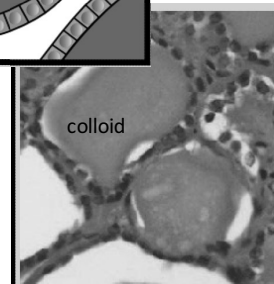
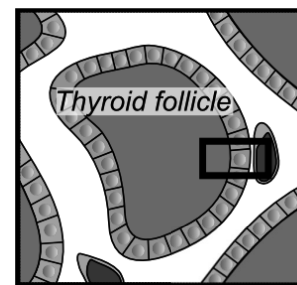
講座大綱

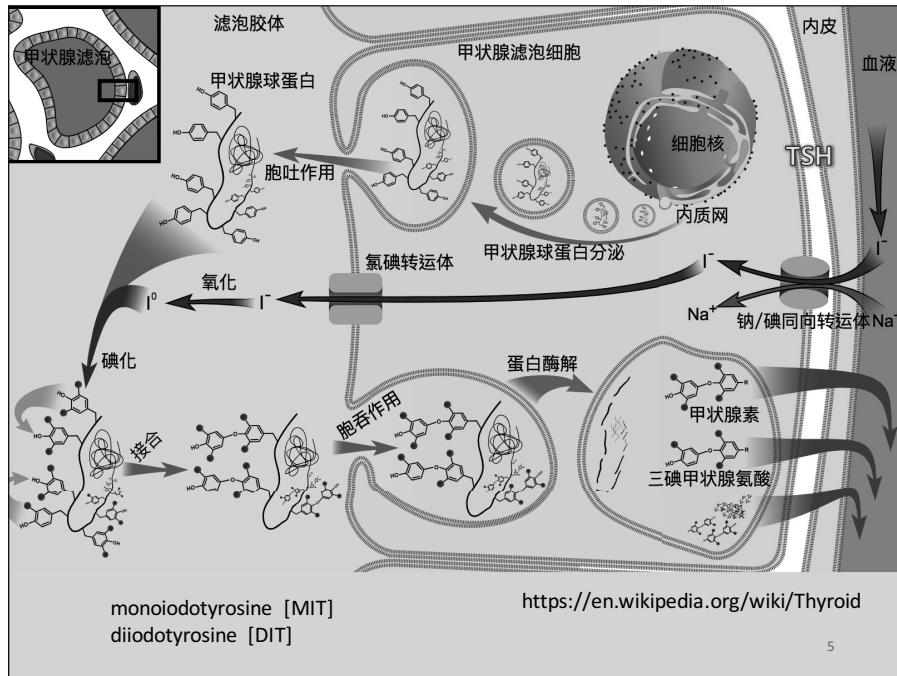
- 甲狀腺生理功能
- 貓甲狀腺機能亢進
- 病因 臨床症狀
- 甲狀腺功能檢測
- 治療方式
- 共病症
- 病例分享



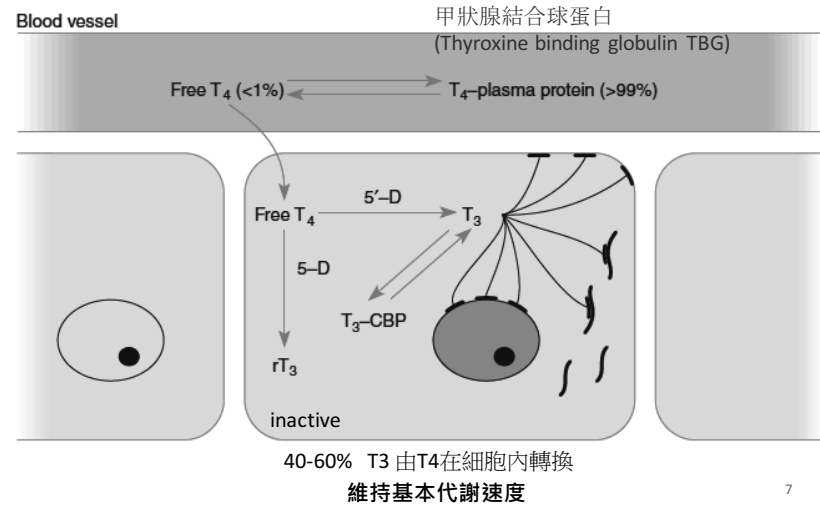
Hyperthyroid

甲狀腺的解剖構造

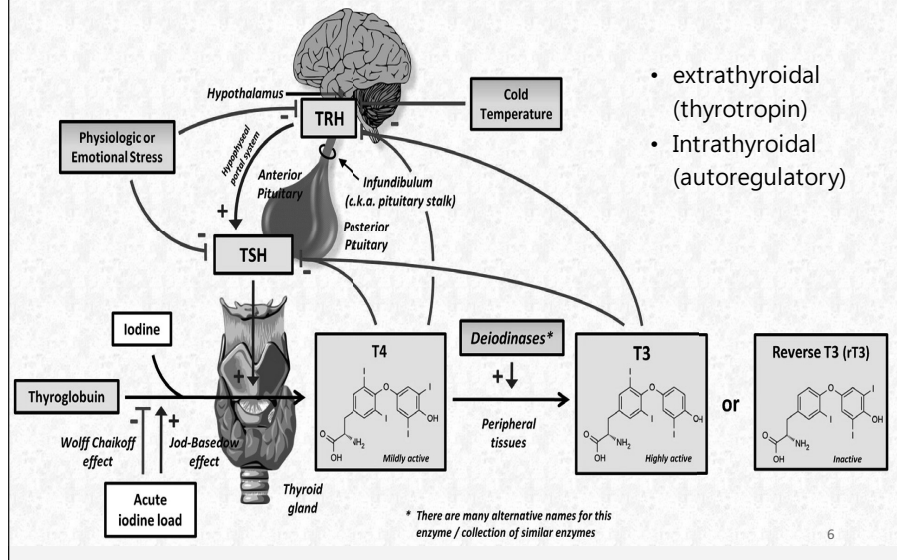




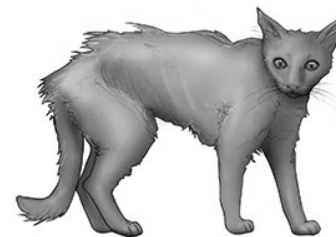
TT4, T3, rT3, fT4, fT3



Normal Regulation of Thyroid Hormones



貓咪甲状腺機能亢進



發生率

- 1980 JAVMA

Hyperthyroidism in the cat: ten cases

- 老貓發生率1.5–11.4% JFMS(2016)18, 400–416
- Hyperthyroidism affects up to 10% of cats older than 10 years in US JFMS(2012)14, 804–818
- 日本：8.9% (N=112) 日獸會誌 (2002) 55,289-292
- 香港：3.9% (N=305) JFMS(2009)11, 315–321

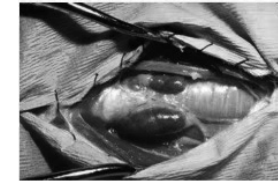
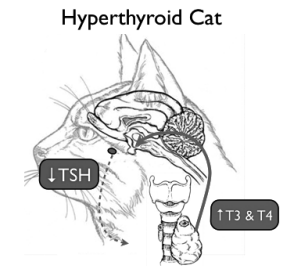
台灣地區貓甲狀腺功能亢進症之盛行率及併發症

- 鄒昆霖 2012屏東科技大學
- 甲亢貓 (TT4 >5.0 µg/dL) 之盛行率為7.2% (18/251)
- 北區為11.1% (11/99)、中區為4.1% (3/73)、南區為5.1% (4/79) · 三區之盛行率並無顯著差異性 (P>0.05)
- 好發年齡為8歲以上11.5% (16/139) · 與6-8歲為2.5% (1/40)和6歲以下為1.4% (1/72)比較 · 呈現顯著差異性 (P<0.05)
- 在不同性別間、10種貓品種間、10種市售飼料品牌間不同飲水方式間 · 以及有無使用驅蟲劑、有無結育、有無疫苗注射間 · 均無顯著差異

10

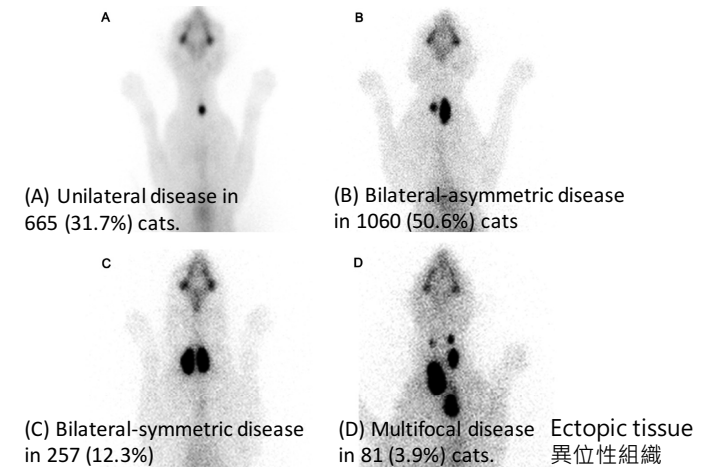
貓甲狀腺功能亢進

- 病因學
 - 良性增生 Adenomatous hyperplasia
 - 良性腺瘤adenoma
 - 惡性腺癌Adenocarcinoma (<5%)



11

Thyroid scintigraphy findings in 2096 cats with hyperthyroidism



Vet Radiol Ultrasound (2014) 1–12

基本資料 危險因子

TABLE 2: Final multivariable logistic regression model results for factors associated with a diagnosis with feline hyperthyroidism among cats attending primary-care practices in England

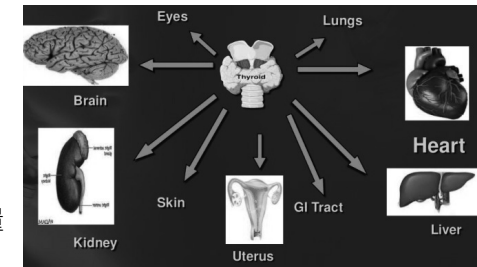
Associated factor	Category	OR	95% CI	P value*
Breed	Non-purebred	1		
	British Shorthair	0.64	0.38 to 1.07	0.091
	Burmese	0.15	0.07 to 0.32	<0.001
	Persian	0.17	0.08 to 0.33	<0.001
	Siamese	0.40	0.21 to 0.75	0.004
	Other purebred	0.37	0.25 to 0.56	<0.001
	Purebred cross	0.45	0.23 to 0.88	0.020
Sex	Male	1		
	Female	1.00	0.90 to 1.11	0.995
Neutering status	Un-neutered	1		
	Neutered	1.03	0.85 to 1.26	0.733
Insurance status	Uninsured	1		
	Insured	1.78	1.56 to 2.03	<0.001
Age group†	17-25	1		
	14-17	0.94	0.83 to 1.07	0.359
	11-14	0.90	0.78 to 1.05	0.169
	6-11	0.83	0.66 to 1.04	0.102

Vet Rec. 8:458 2014

甲狀腺素的功能

- 增加代謝速度 base metabolic rate (BMT)
 - 增加氧代謝速度
 - 提高血糖 · 脂肪 · 蛋白質代謝

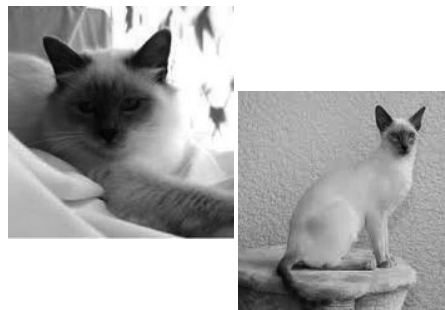
- 多系統性影響
- 神經系統
- 骨骼肌肉
 - 生長速度
- 心臟
 - 增加心跳 · 心輸出量
 - 增加呼吸速度



15

危險因子

- 多因子影響
- 純種動物發生率較低
- Goitrogenic factors
 - (TSH) stimulation
 - direct mitogens



- 罐頭 · 環境 · 貓砂
 - Lined pop-top cans (BPA)
 - Bisphenol A 雙酚A
 - fire-retardant PBDE 多溴二苯醚
 - iodine content

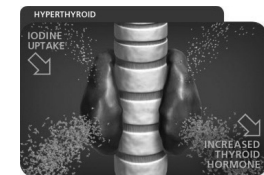


BISPHENOL-A

14

多系統影響

- 心血管系統
 - 心跳加速
 - 肥厚性心肌病
 - X-ray, Echo
- 系統性高血壓
 - 視網膜剝離/出血
 - 血壓測量
- 腸胃道疾病
 - 多吃 · 體重減輕
 - 無食慾 · 下痢/嘔吐
- 慢性腎臟病
 - 高甲狀腺會提高GFR
 - 完整腎臟評估
 - 生化 · 尿比重 · 尿蛋白
- 泌尿道感染
 - E coli
 - 尿液檢查 細菌培養
- 糖尿病
 - 胰島素阻抗



16

典型臨床症狀

- 體重減輕
- 多吃
- 多渴多尿
- 增加活動力
- 嘔吐下痢
- 皮毛油膩，脫毛，蓬鬆雜亂
皮毛打結
- 性格變化：活動力上升，攻擊，更為親人



17

理學檢查

- 體重下降
- 甲狀腺觸診腫大
- 消瘦，肌肉消耗(BCS, MCS)
- 聽診：心跳快，心雜音，奔馬音
- 呼吸急促，開口呼吸
- 毛髮品質不良
- 眼底檢查，散瞳
- 血壓評估



<http://www.animalendocrine.info/>

非典型臨床症狀

- 食慾不佳
- 活力低下 昏睡
- 肥胖 虛弱
- 沒有症狀 ~ ~



- Apathetic hyperthyroidism
- Asymptomatic hyperthyroidism

18

Nestlé PURINA
BODY CONDITION SYSTEM

TOO THIN	1	Ribs visible on shorthaired cats; no palpable fat; severe abdominal tuck; lumbar vertebrae and wings of ilia easily palpated.		1
	2	Ribs easily visible on shorthaired cats; lumbar vertebrae obvious with minimal muscle mass; pronounced abdominal tuck; no palpable fat.		2
	3	Ribs easily palpable with minimal fat covering; lumbar vertebrae obvious; obvious waist behind ribs; minimal abdominal fat.		3
	4	Ribs palpable with minimal fat covering; noticeable waist behind ribs; slight abdominal tuck; abdominal fat pad absent.		4
IDEAL	5	Well-proportioned; observe waist behind ribs; ribs palpable with slight fat covering; abdominal fat pad minimal.		5
TOO HEAVY	6	Ribs palpable with slight excess fat covering; waist and abdominal fat pad distinguishable but not obvious; abdominal tuck absent.		6
	7	Ribs not easily palpated with moderate fat covering; waist poorly discernible; obvious rounding of abdomen; moderate abdominal fat pad.		7
	8	Ribs not palpable with excess fat covering; waist absent; obvious rounding of abdomen with prominent abdominal fat pad; fat deposits present over lumbar area.		8
	9	Ribs not palpable under heavy fat cover; heavy fat deposits over lumbar area, face and limbs; distention of abdomen with no waist; extensive abdominal fat deposits.		9

Normal muscle mass

Mild muscle loss

Moderate muscle loss

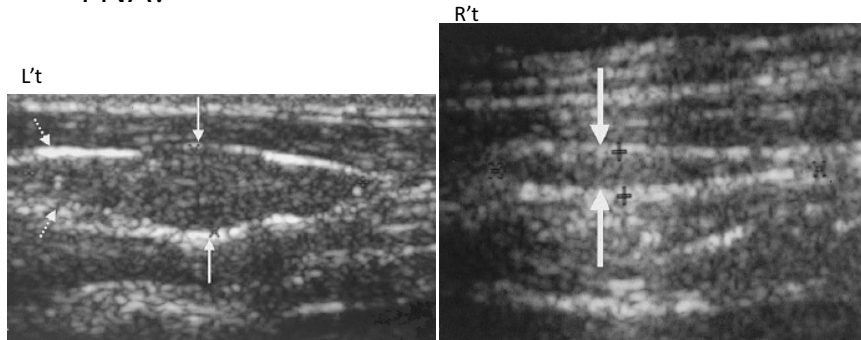
Severe muscle loss

Call 1-800-222-VETS (8387), weekdays, 8:00 a.m. to 4:30 p.m. CT

Nestlé PURINA

頸部甲狀腺超音波檢查

- 觸診後，確認頸部團塊狀況
- FNA?

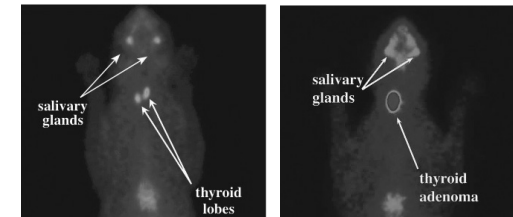


13-year-old domestic short-haired cat

21

診斷 Thyroid function testing

- Total T4
- Free T4
- cTSH
- T3 suppression test
- Quantitative technetium uptake 核醫檢查
Tc -99m



23

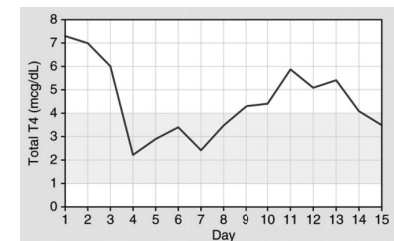
實驗室檢查

- CBC:
 - Mild erythrocytosis (50%)
 - Stress leukogram
- Chem
 - ALT, ALP
 - BUN, CRE, P
 - Hyperglycemia
- UA
 - USG
 - UPC
- Minimum Database
CBC, Chem, UA
- non-thyroidal illness
甲狀腺正能症
- 老年健檢
 - TT4
 - FeLV/FIV

22

Total T4 Concentration

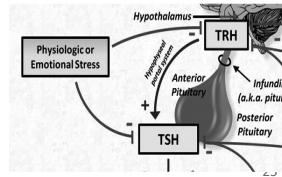
- >7y 老年健檢 Initial screening
- <7y 有懷疑症狀的貓咪
- 高敏感高特異度的檢查，目前最好的診斷工具
- 仍有偽陰性或偽陽性的機會
- 其他影響因子：
 - TT4 波動性
 - Euthyroid Sick Syndrome



24

Euthyroid Sick Syndrome 甲狀腺正能症

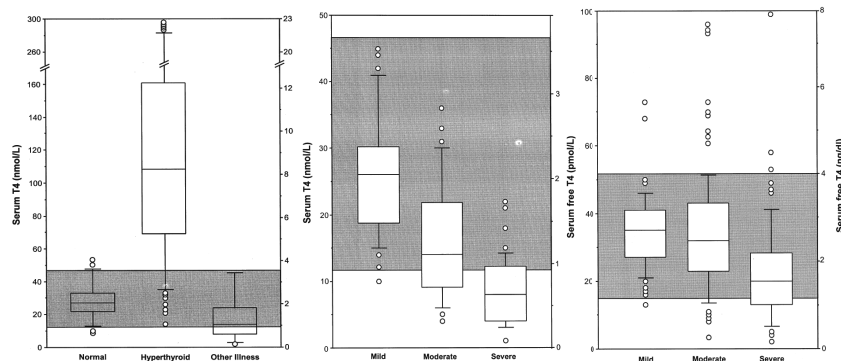
- Non-thyroidal illness syndrome (NTIS)
- 其他疾病造成甲狀腺素低下
- 多為全身性疾病，創傷，手術等造成
- 身體的保護機制，降低細胞代謝速度
- 抑制TSH分泌, 降低T4, fT4合成
- 與疾病嚴重程度成正比
- fT4影響程度較tT4小



tT4 與甲狀腺正能症

- 與疾病嚴重程度相關
- 可等待疾病恢復後再檢驗

JAVMA (2001)218:529-536



Total T4

- occult hyperthyroidism
- 不要草率的診斷或排除，fT4, TSH,
- 等2-4週後再驗
- 內分泌是漸進式

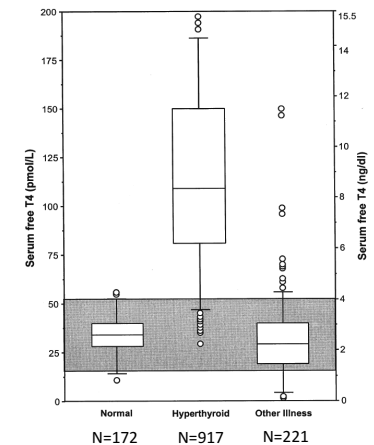
SERUM T ₄ CONCENTRATION	PROBABILITY OF HYPERTHYROIDISM
>5.0 µg/dL	Very likely
3.0-5.0 µg/dL	Possible
2.5-3.0 µg/dL	Unknown
2.0-2.5 µg/dL	Unlikely
<2.0 µg/dL	Very unlikely*

*If a severe systemic illness is not present.

27

Free Thyroxine fT4

- Equilibrium Dialysis (free T₄ ED)
- 高敏感度95% occult hyperthyroidism
- 不可單一當作診斷 FHT工具
 - nonthyroidal illness syndrome 影響，造成fT4上升，偽陽性

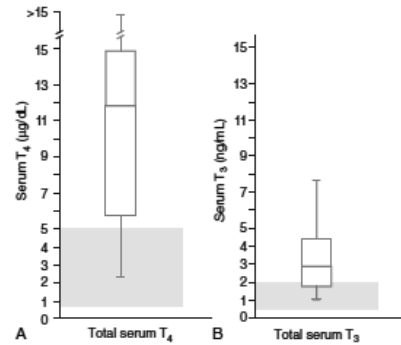


JAVMA (2001)218:529-536

28

total triiodothyronine (TT3)

- 30% hyperthyroid cat · TT3在正常範圍
- 診斷率不高

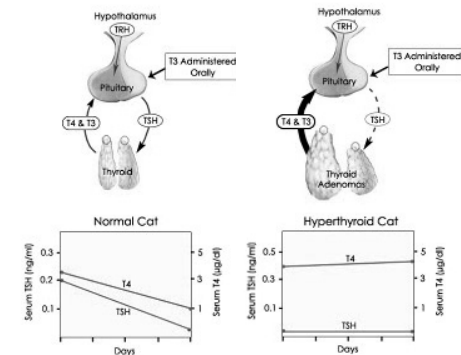


JAVMA (2001)218:529-536 29

T3 suppression test

- 黃金診斷
- mild hyperthyroidism
- TT4 · fT4也無法判定

- 口服T3: 25µg tid*7
- 抽血 T4, T3
 - 給藥前
 - 最後一次給藥後 8 hr
- 正常 : T4 < 1.5µg/dl 或下降 > 50%
- Hyperthyroidism : T4 > 2.0µg/dl



31 <http://www.animalendocrine.info/>

Serum cTSH Levels

- Immunoradiometric assay
- 只有狗狗可以檢驗，貓咪用狗的



- Normal: 0.03-0.15 ng/ml
- hyperthyroidism: TSH測不到 < 0.03 ng/ml
 - 在正常的貓咪也可能測不到
 - 未來發展成甲狀腺亢進的機會高
 - subclinical hyperthyroidism

30

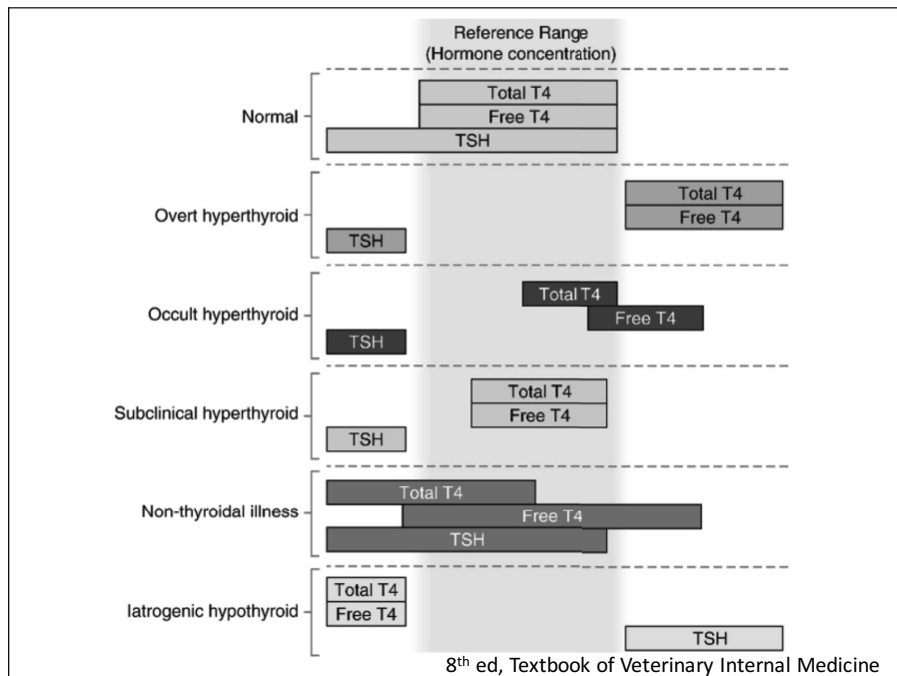
綜合診斷

臨床症狀！！
觸診：腫大的甲狀腺
Thyroid function testing

	T4	fT4	TSH
Normal	正常	正常	正常
Non-thyroidal illness syndrome	正常低/下降	正常/上升	正常/降低
Hyperthyroidism	正常高/上升	上升	測量不到

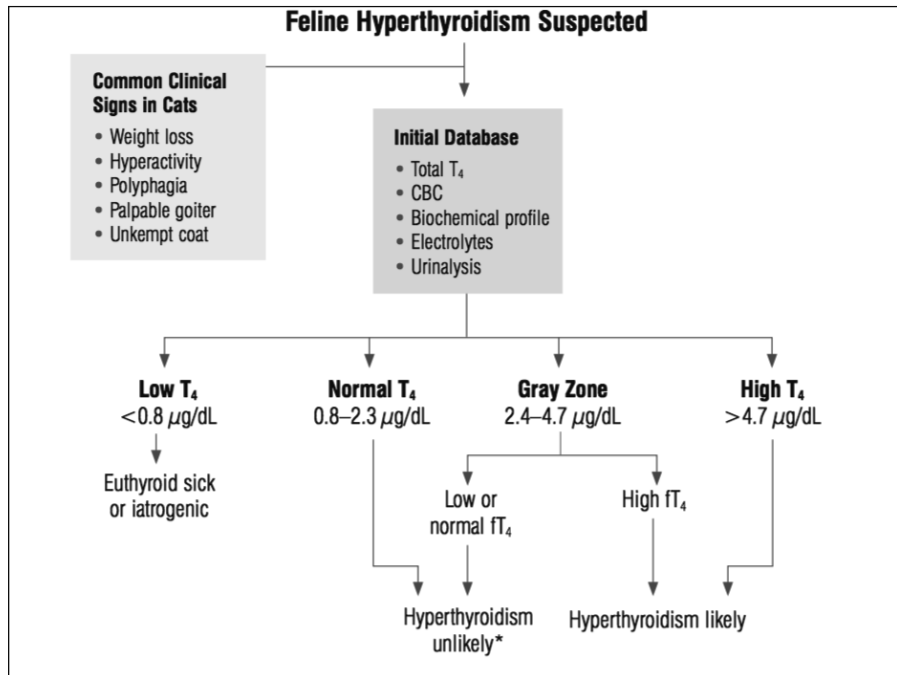
不可以單一的fT4作為診斷

32



2010 AAFP/AAHA Feline Life Stage Guidelines

	The Minimum Database by Age Group			
	Kitten/junior	Adult	Mature	Senior/Geriatric
CBC Hematocrit, RBC, WBC, differential count, cytology, platelets	+/-	+/-	+	+
CHEM screen As a minimum include: TP, albumin, globulin, ALP, ALT, glucose, BUN, creatinine, K ⁺ , phos, Na ⁺ , Ca ²⁺	+/-	+/-	+	+
Urinalysis* Specific gradient, sediment, glucose, ketones, bilirubin, protein ²³	+/-	+/-	+	+
T4*		+/-	+/-	+
Blood pressure*		+/-	+/-	+
Retroviral testing	+	+/-	+/-	+/-
Fecal examination*	+	+	+	+



多方向診断

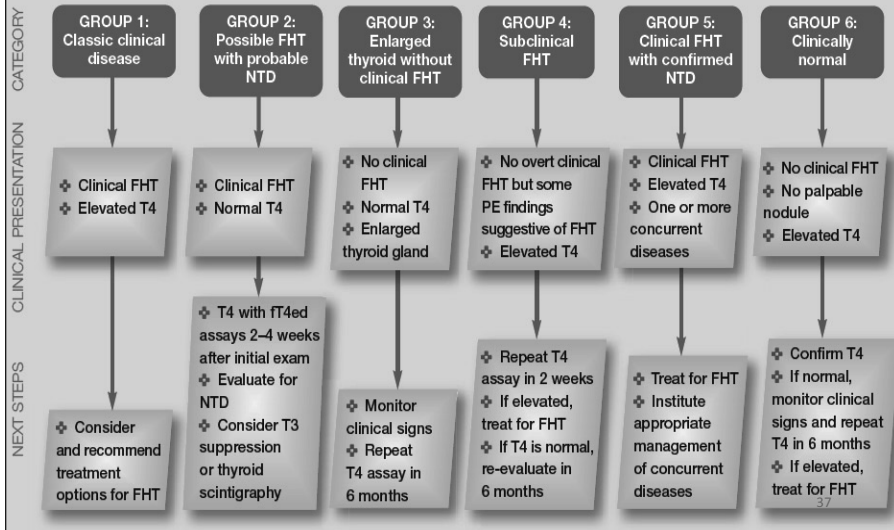
- 臨床症狀！！
- 觸診：腫大的甲狀腺
- Thyroid testing
- Minimal database



2016 AAFP feline hyperthyroidism guidelines

Summary of the categorical approach to diagnosing suspected feline hyperthyroidism

After evaluating signalment, history, physical exam and a minimum database, patients will present as:

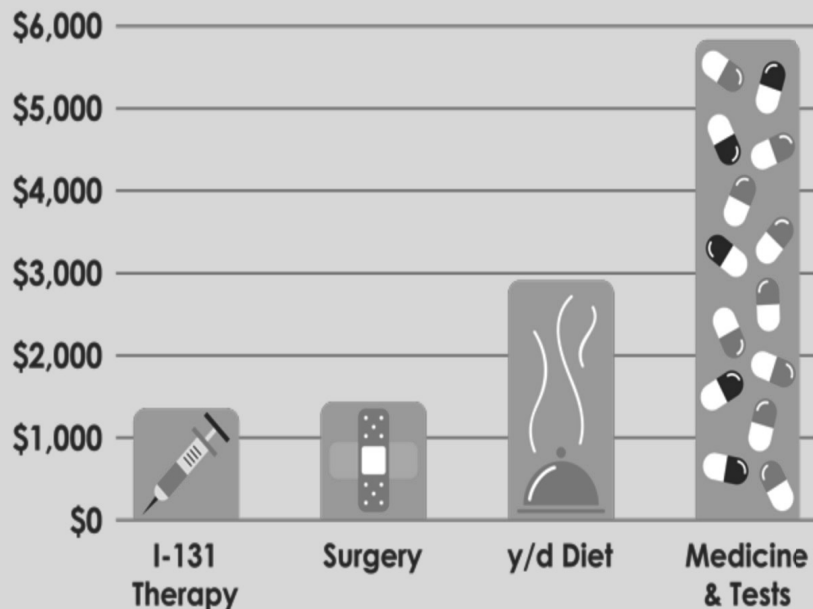


治療

- 具生命危險，確診後都需治療
- 甲亢加速腎臟損傷
- 影響治療選擇因子
 - 年齡
 - 其他疾病
 - 治療方式的選擇性
 - 飼主
 - 治療反應，轉換

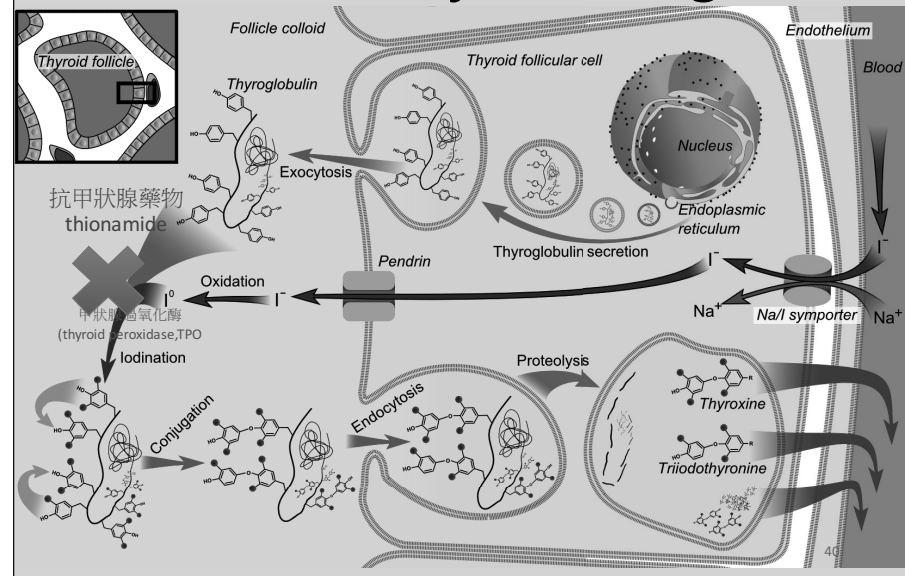


39



<http://www.vrhoh.com/iodine-therapy.php>

藥物治療 Antithyroid drugs



40

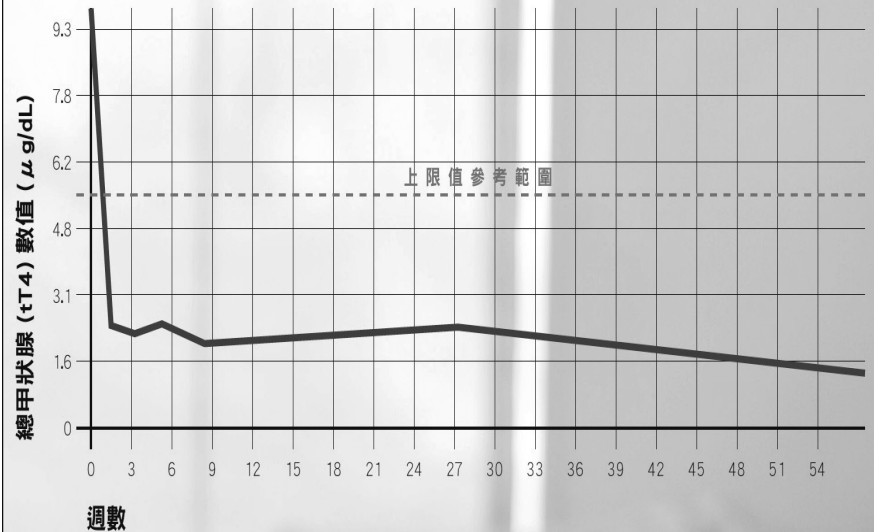
藥物治療 Antithyroid drugs

- 初步治療選擇
- 了解腎臟狀況
- 用以等待其他治療
- 終身服用



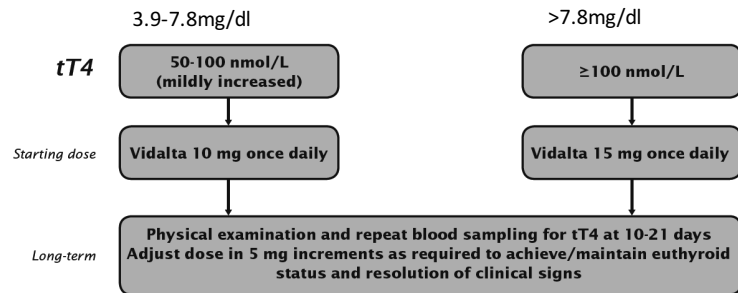
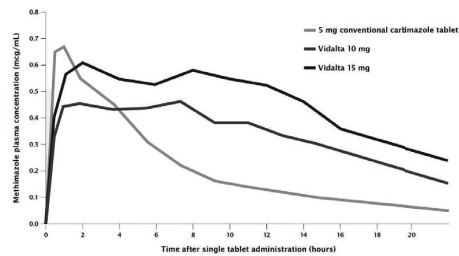
- Methimazole
 - 1.25–2.5 mg/cat bid (q12h)
 - 每次調整 1.25–2.5 mg/day
- Carbimazole (pro-drug of methimazole)
- No antigrowth effect

甲亢寧® 治療甲狀腺功能亢進症，其總甲狀腺 (tT4) 數值的長期改善。



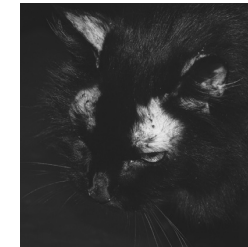
每天使用一次甲亢寧 15mg，於 tT4 的中位數 9.2 μg/dL (範圍 3.9-24.9 μg/dL) 和出現甲狀腺亢進臨床症狀的貓 (總計 39 隻)，如果需要調整劑量，在第 10 天、3 週、5 週、8 週及 26 週時進行⁶。

Prolonged release profile of Vidalta



藥物治療 Anti-Thyroid drugs

- 監控
 - 副作用
 - 使用最低有效劑量
 - 隨時間增加劑量
 - 了解治療目標
 - 避免造成低甲狀腺
- 副作用 (前三個月)
 - 腸胃不適 嘔吐
 - 臉部搔癢
 - 肝毒性
 - 血液惡病質 blood dyscrasias (leukopenia, anemia thrombocytopenia) 和劑量無關



監控 Anti-Thyroid drugs

- BCS, muscle score
- 症狀改善 · 避免 iatrogenic hypothyroidism
- 第一次追蹤 2-4週
- 每次調整劑量後 2-4週
- TT4: without CKD: 1- 2.5 µg/dl
- TT4: New CKD: 2.0-3.0 µg/dl
- TT4 : with CKD: 2.5-4 µg/dl
- 穩定後約每 3-6個月 · 完整評估
- CBC, Renal, Liver
- minimum database MDB



45

Radioactive iodine 放射線碘治療

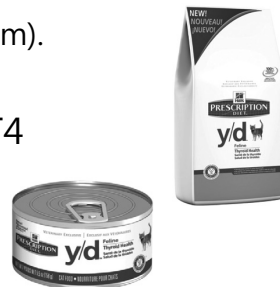
- 成功率達95%
- 復發率低
- 需住院以代謝放射線物質
- 治療後少有低下的可能
- 在美國首選根除治療
- 目前台灣沒有
- functional extrathyroidal tissue
- Monitor T4 +/- fT4 +/- TSH at 1, 3, 6, 12 months



47

飲食治療

- 無法餵藥的貓咪
- Restricted iodine food from Hill' s® Prescription Diet®
 - 0.2 ppm iodine
 - euthyroid adult cats (0.46 ppm).
- 食物轉換需一段時間
- 建議 第4, 8,12 weeks 追蹤TT4
- 75% 4周後TT4下降
- 約八週後TT4達穩定



46

Surgical thyroidectomy 手術 甲狀腺切除

- 全身麻醉(藥物控制穩定)
- 單側 雙側切除
- 需純熟的手術技術
- technetium thyroid scan
- 併發症
 - 高甲狀腺症復發 (單側切除30%, 雙側切除 5%)
 - Hypothyroidism
 - Hypoparathyroidism (hypocalcemia)
 - Laryngeal paralysis
 - Horner' s syndrome
 - 聲音改變



48

治療方式比較

	THIOUREYLENE DRUGS	RADIOIODINE	THYROIDECTOMY
Initial cost	Low	High	High
Long-term cost	Moderate	Low	Low
Anesthesia	Never	Sometimes	Always
Ease of use	Easy	Moderate	Difficult
Recurrence	Common	Rare	Moderate
Time to euthyroid	2-4 weeks	Immediate	2-4 weeks
Hospitalization	None	3-10 days	1-3 days
Blood dyscrasias	Rare	Never	Never
Hypocalcemia	Never	Never	Common
GI side-effects	Common	Never	Never

8th ed, Textbook of Veterinary Internal Medicine

預後

- 平均存活年齡：2 年
- 單純性預後良好
- 若完全無其他疾病：5.3 年
- 早期發現，定期健檢
- thyroid carcinoma 預後較差
- 不同治療模式，不同預後
 - 放射線碘治療：4年
 - 口服藥：2年



50

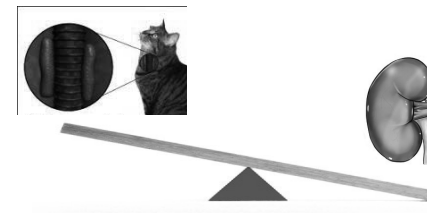


- 慢性腎病
- 心臟病
- 糖尿病

甲狀腺機能亢進
常見共病症

甲狀腺機能亢進與慢性腎病

- 約有1/3的甲亢貓，合併有慢性腎病
- 治療前的分期 IRIS staging CKD
- CKD case: 治療甲亢後可能會改變腎臟病分級
- 待TT4穩定，須持續追蹤腎指數
- 監控TT4: 落在中高值 2.5-4 $\mu\text{g}/\text{dl}$



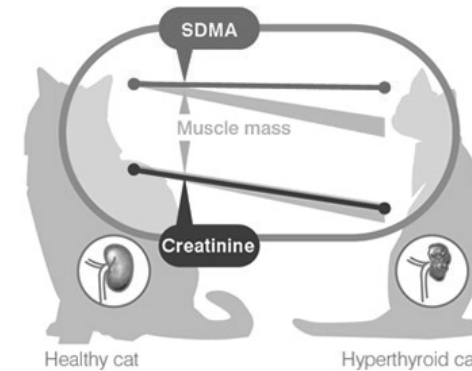
52

甲狀腺機能亢進與慢性腎病

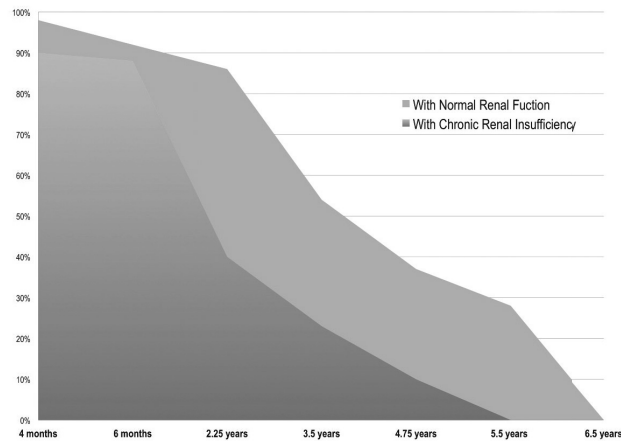
- 治療甲亢後，揭露原本存在慢性腎病unmasked
- 機制：降低代謝速度
 - glomerular filtration rate (GFR)
 - renal blood flow (RBF)
- newly-diagnosed azotemia
 - Mild CKD (IRIS stage 2, cre: 1.6-2.8)
- 甲亢會影響腎臟功能，一定要治療甲亢
 - renal injury
 - glomerular hyperfiltration
- 避免造成 iatrogenic hypothyroidism

53

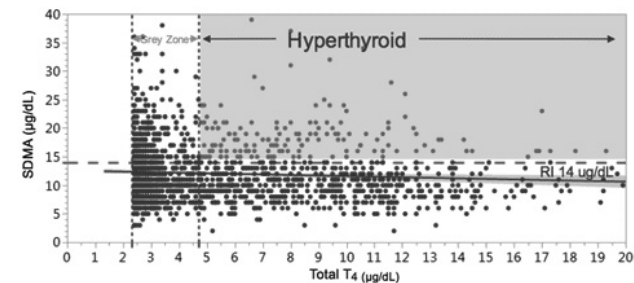
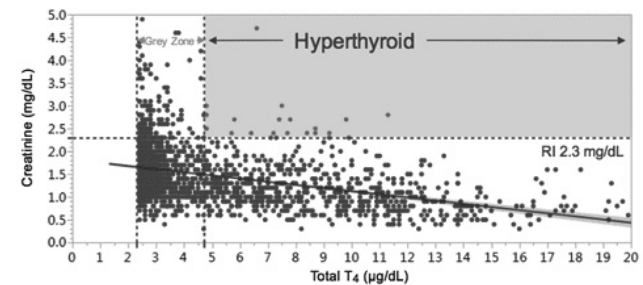
甲狀腺機能亢進與SDMA



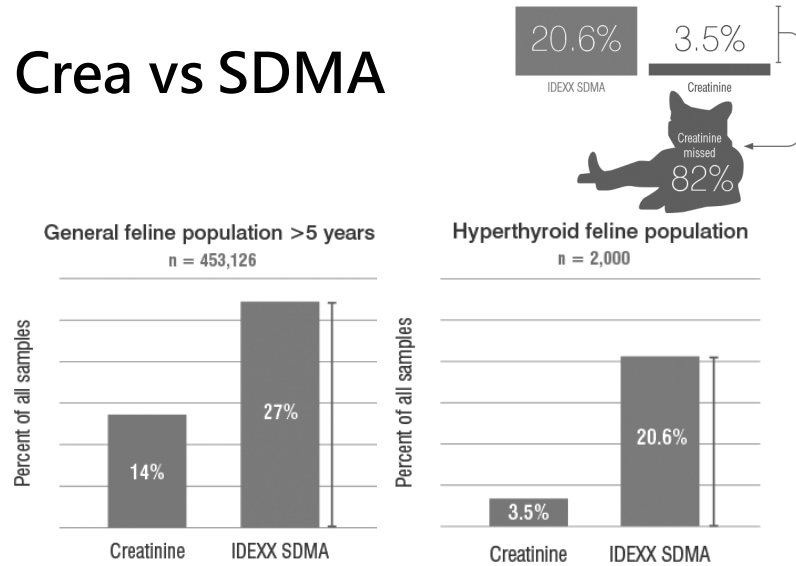
存活統計



2016 AAFP feline hyperthyroidism guidelines



Crea vs SDMA



甲狀腺機能亢進與糖尿病

- 甲狀腺亢進，胰島素阻抗
- Insulin 劑量須隨甲狀腺機能亢進的治療做調整

- 有甲亢的糖尿病貓咪
 - 增加血糖
 - 降低果糖胺
- 泌尿道感染



59

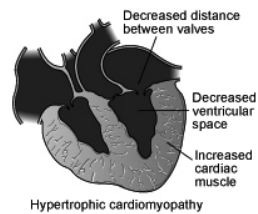
甲狀腺機能亢進及心臟病

- Hypertrophic thyrotoxic cardiomyopathy
- Dilative thyrotoxic cardiomyopathy

- NT-proBNP 上升

- hyperthyroid cats

- 治療後TT4正常euthyroid state，約三個月NT-proBNP可下降



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58

病例討論



這是一個關於稀飯的故事

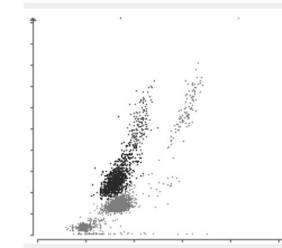
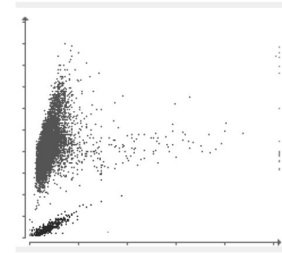
- DSH, FS, 9y
- 外傷，從小就愛講話
- 慢性嘔吐約一年
- 食慾一直很好
- 肝指數高，轉診做超音波檢查



Hematology

9/18/18 2:42 PM

TEST	RESULT	REFERENCE VALUE
RBC	11.34	6.54 - 12.2 M μ /L
Hematocrit	47.9	30.3 - 52.3 %
Hemoglobin	15.7	9.8 - 16.2 g/dL
MCV	42.2	35.9 - 53.1 fL
MCH	13.8	11.8 - 17.3 pg
MCHC	32.8	28.1 - 35.8 g/dL
RDW	27.7	15.0 - 27.0 %
% Reticulocyte	0.7	%
Reticulocytes	79.4	3 - 50 K μ /L
Reticulocyte Hemoglobin	16.4	13.2 - 20.8 pg
WBC	4.5	2.87 - 17.02 K μ /L
% Neutrophils	58.8	%
% Lymphocytes	35.1	%
% Monocytes	3.3	%
% Eosinophils	2.4	%
% Basophils	0.4	%
Neutrophils	2.64	1.48 - 10.29 K μ /L
Lymphocytes	1.58	0.92 - 6.88 K μ /L
Monocytes	0.15	0.05 - 0.67 K μ /L
Eosinophils	0.11	0.17 - 1.57 K μ /L
Basophils	0.02	0.01 - 0.26 K μ /L
Platelets	278	151 - 600 K μ /L
MPV	14.3	11.4 - 21.6 fL
Plateletcrit	0.40	0.00 - 0.79 %

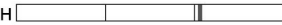



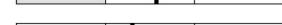


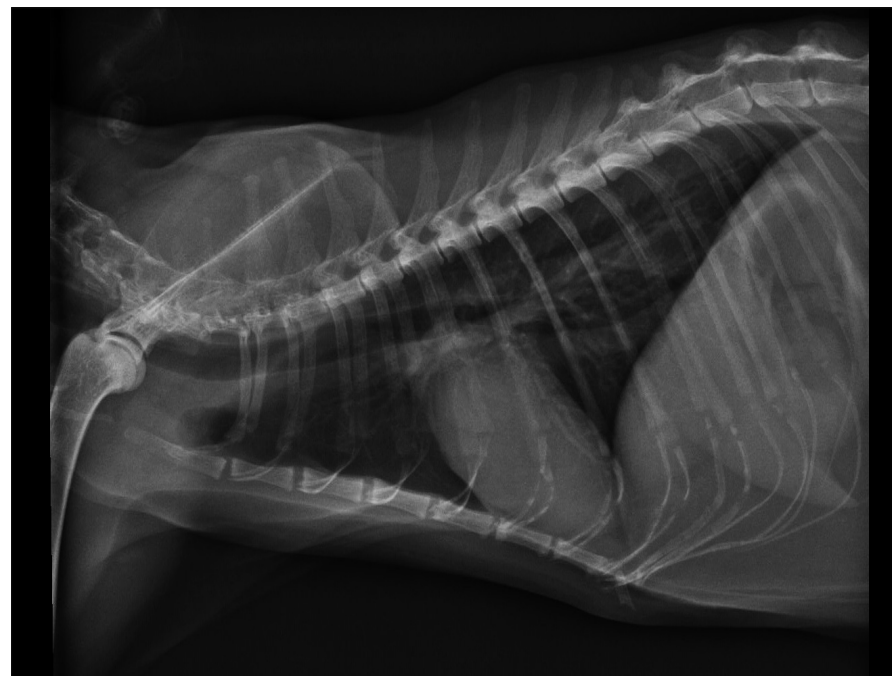
理學檢查



- BW:3.2kg, HR: 250
- BT: 38.7
- BCS:4/9,
- 甲狀腺腫大
- 呼吸急促，開口呼吸
- 心雜音
- SBP: 145mmHg




TEST	RESULT	REFERENCE VALUE	
Glucose	97	71 - 159 mg/dL	
IDEXX SDMA	^c 11	0 - 14 μ g/dL	
Creatinine	0.6	0.8 - 2.4 mg/dL	L
BUN	15	16 - 36 mg/dL	L
BUN: Creatinine Ratio	24		
Phosphorus	6.1	3.1 - 7.5 mg/dL	
Calcium	10.1	7.8 - 11.3 mg/dL	
Sodium	163	150 - 165 mmol/L	
Potassium	4.0	3.5 - 5.8 mmol/L	
Na: K Ratio	41		
Chloride	124	112 - 129 mmol/L	
Total Protein	6.8	5.7 - 8.9 g/dL	
Albumin	2.8	2.3 - 3.9 g/dL	
Globulin	4.0	2.8 - 5.1 g/dL	
Albumin: Globulin Ratio	0.7		

TEST	RESULT	REFERENCE VALUE	
ALT	207	12 - 130 U/L	H 
ALP	241	14 - 111 U/L	H 
GGT	0	0 - 4 U/L	
Bilirubin - Total	0.5	0.0 - 0.9 mg/dL	
Cholesterol	111	65 - 225 mg/dL	
Osmolality	322	mmol/kg	



Endocrinology  

9/18/18 3:06 PM 9/18/18 2:07 PM

TEST	RESULT	REFERENCE VALUE	
Total T4	19.4	0.8 - 4.7 µg/dL	H  > 20

手動二倍稀釋 38.8!!

Feline Hyperthyroidism Suspected

Common Clinical Signs in Cats

- Weight loss
- Hyperactivity
- Polyphagia
- Palpable goiter
- Unkempt coat

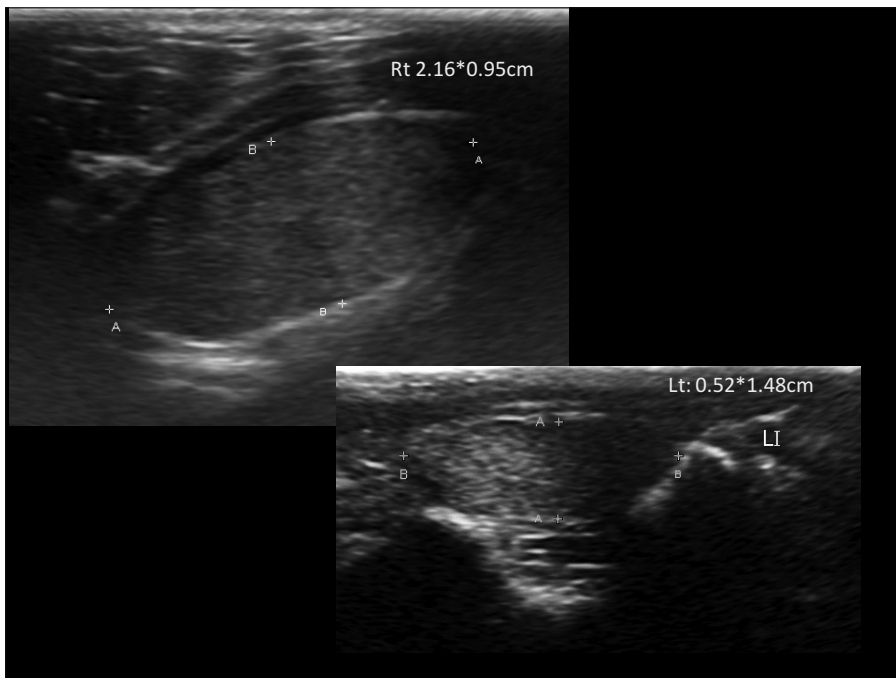
Initial Database

- Total T₄
- CBC
- Biochemical profile
- Electrolytes
- Urinalysis

```

graph TD
    A[Feline Hyperthyroidism Suspected] --> B[Initial Database]
    B --> C[Low T4 <0.8 µg/dL]
    B --> D[Normal T4 0.8-2.3 µg/dL]
    B --> E[Gray Zone 2.4-4.7 µg/dL]
    B --> F[High T4 >4.7 µg/dL]
    C --> G[Euthyroid sick or iatrogenic]
    D --> H[Hyperthyroidism unlikely*]
    E --> I[Low or normal FT4]
    E --> J[High FT4]
    I --> H
    J --> K[Hyperthyroidism likely]
    F --> K
  
```





Day 14, Day 28 回診

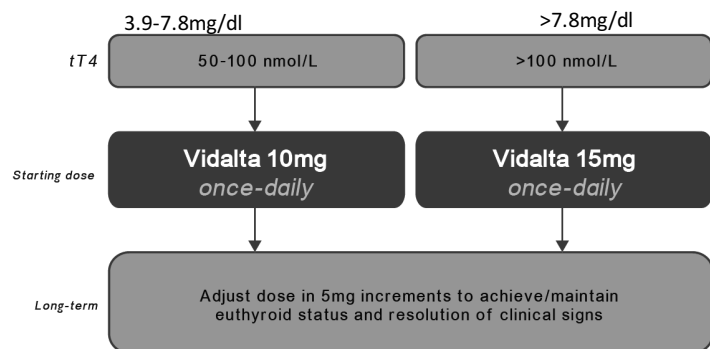
- 呼吸改善
- 腸胃道症狀改善
- 多喝多尿改善

	BW: 3.4kg	BW: 3.5kg	BW: 3.2kg	
Endocrinology	10/16/18 9:26 AM	10/2/18 9:55 AM	9/18/18 3:06 PM	9/18/18 2:07 PM
➤ Total T4	a 11.4	b 10.1	c 19.4	d >20
			38.8	
	15mg	10mg	15mg	
	10mg	10mg		

治療 2018/9/18 day0

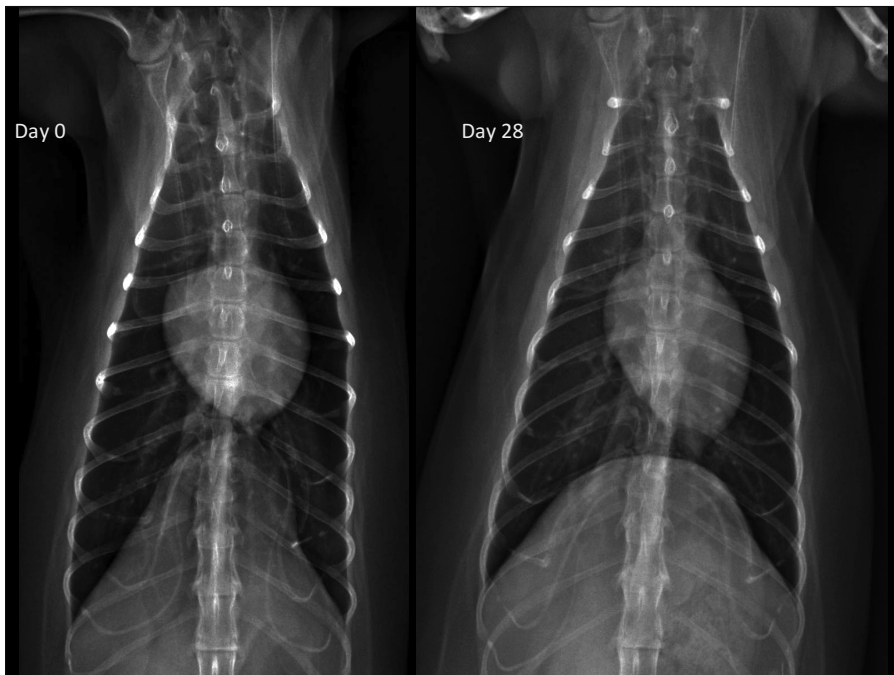
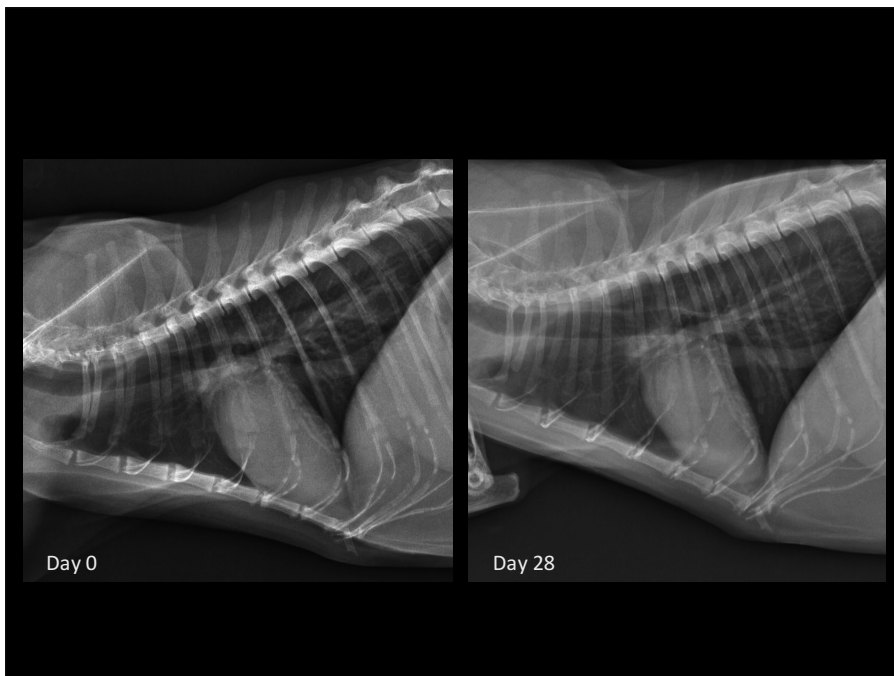


- Vidalta (Carbimazole 15mg) sid po



Chemistry	10/16/18 9:26 AM	10/2/18 9:55 AM	9/18/18 2:48 PM
➤ IDEXX SDMA	a 11	b 8	c 11
➤ Creatinine	1.0	0.9	0.6
➤ BUN	21	24	15
➤ BUN: Creatinine Ratio	21	28	24
➤ ALT	115	140	207
➤ ALP	144	140	241





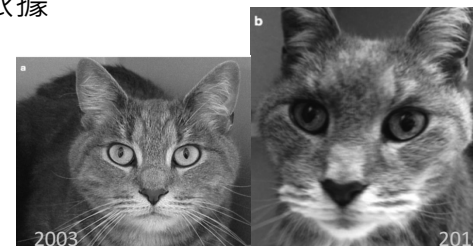
稀飯 小總結

- 持續觀察追蹤中
- 飼主可能察覺不出來的臨床症狀
- 早期檢驗，早期治療
- 完整的MDB
- 持續藥物調整，定期追蹤TT4
- 肝腎指數密切監控



Take Home Message

- 臨床症狀
- 老貓健檢必要項目 >10y (>7y)
- 甲狀腺觸診
- MDB區別Non-thyroidal illness syndrome
- tT4是重要的診斷依據
- 甲亢與慢性腎病



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Dr. Mark E. Peterson is a world-renowned veterinarian specializing in endocrinology (hormonal disorders). Dr. Peterson treats dogs and cats in his two endocrine clinics, lectures frequently to audiences around the world, and conducts clinical research.



貓咪甲狀腺機能亢進
健檢做得好
甲亢沒煩惱

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