SDMA 實戰攻略

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07/15/2018

講座目標

- 什麼是SDMA
- SDMA, Cre 不同情境病例分享
- 關於CKD, SDMA，我該記得什麼

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1 in 3 + 1 in 10

will develop kidney disease.

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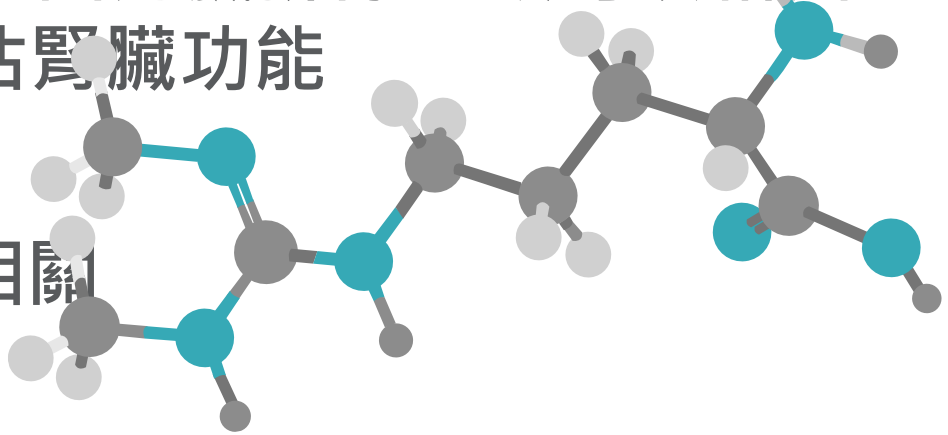
Symmetric Dimethylarginine

– SDMA=對稱二甲基精氨酸

- 體內有核細胞產生甲基精氨酸 (Methylated arginine)，在蛋白質代謝降解的過程SDMA釋放到血液中

–SDMA由於幾乎完全經由腎臟排除，故可以藉由血中濃度的測量來評估腎臟功能

–與絲球體濾過率GFR相關



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SDMA 三大關鍵

Biomarker for kidney function

Increases earlier than creatinine

Specific for kidney function

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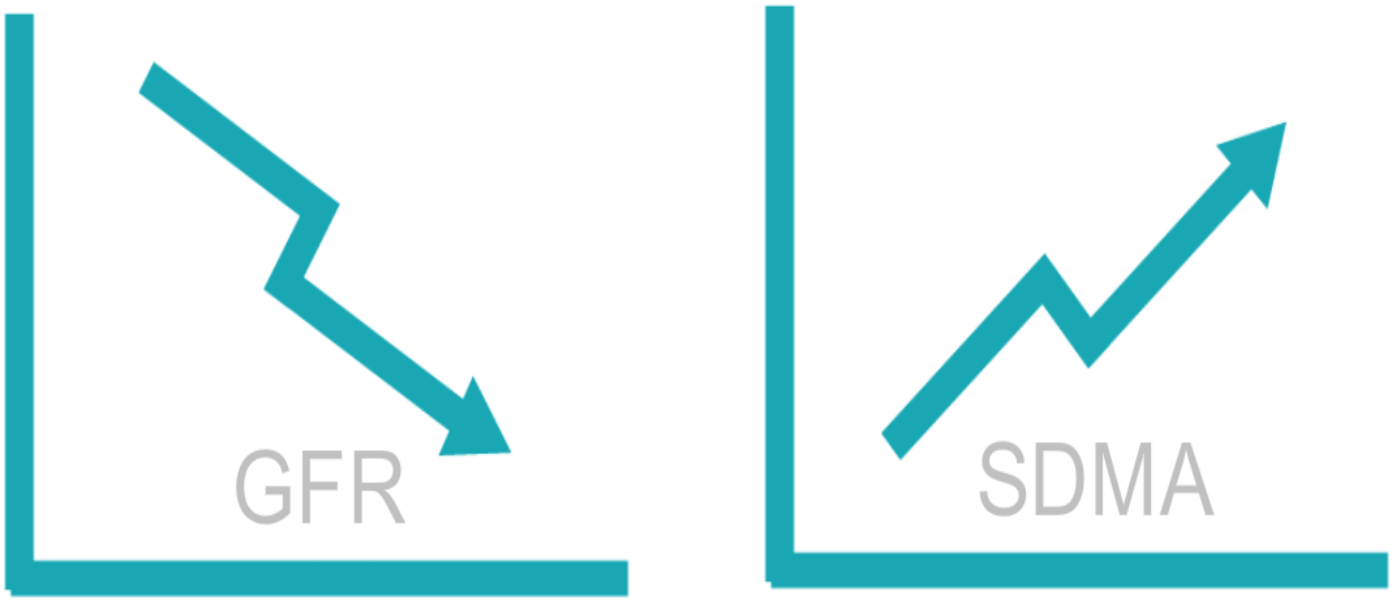
SDMA ：良好的腎臟指標



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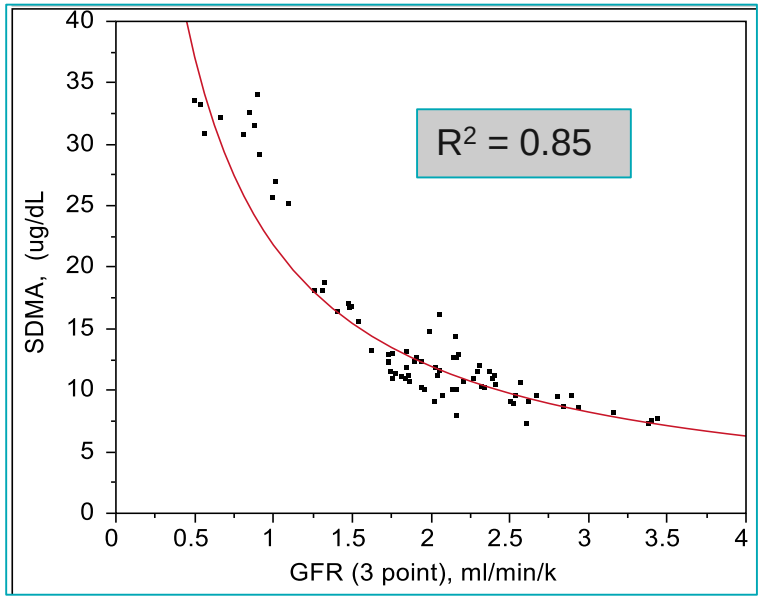
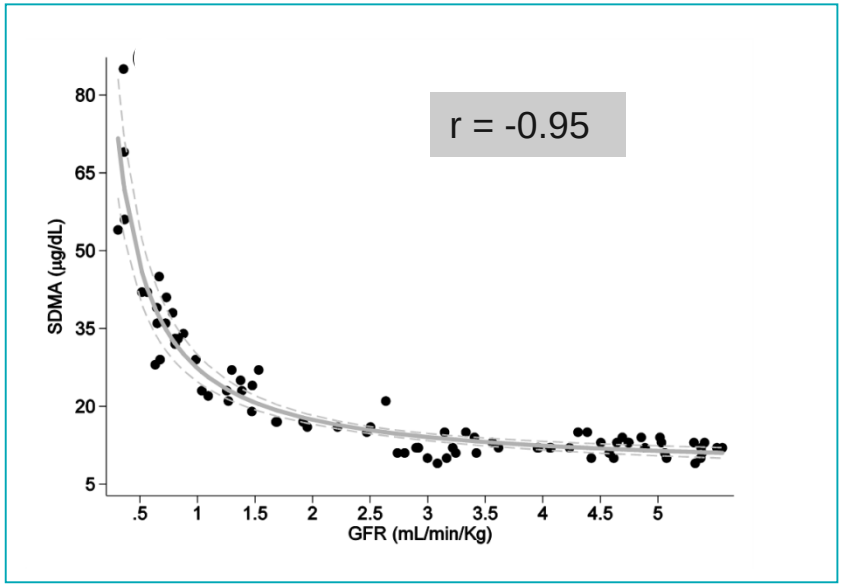
SDMA vs. GFR 狗篇





Reference
As observed by Mary Nabity, DVM, PhD, DAVCP, Texas A&M University
Publication pending

Reference
Nabity MB, Lees GE, Boggess MM, Yerramilli M, et al. SDMA assay validation, stability, and evaluation as a marker for early detection of chronic kidney disease in dogs. J Vet Intern Med 2015. (Accepted pending revisions; resubmitted with requested revisions)

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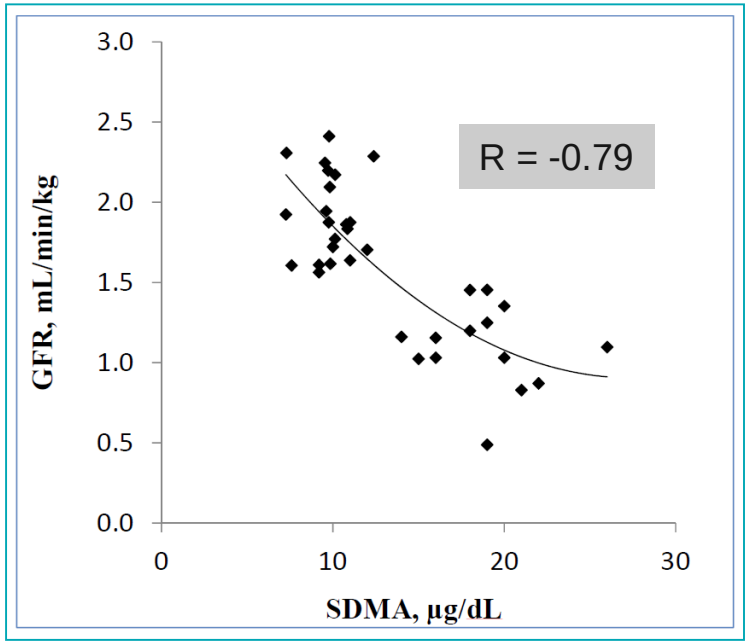
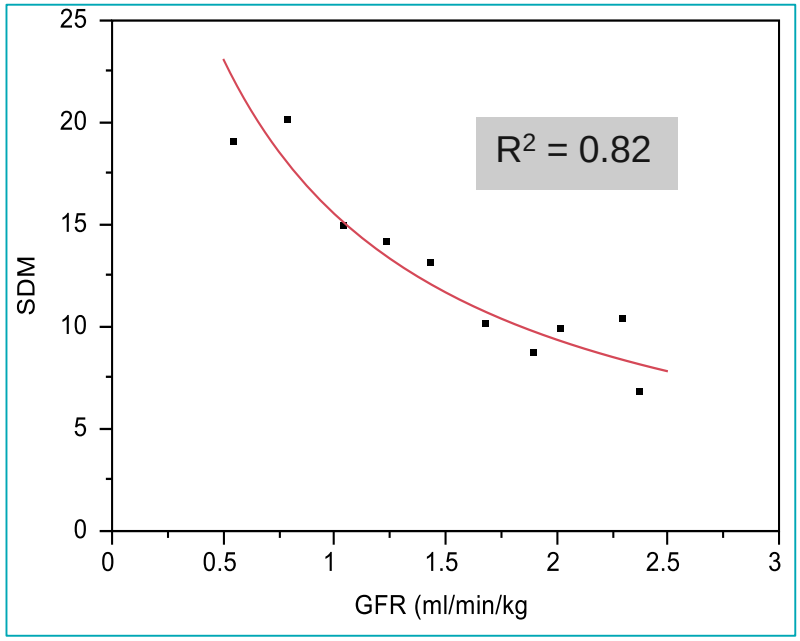
SDMA vs. GFR 貓篇





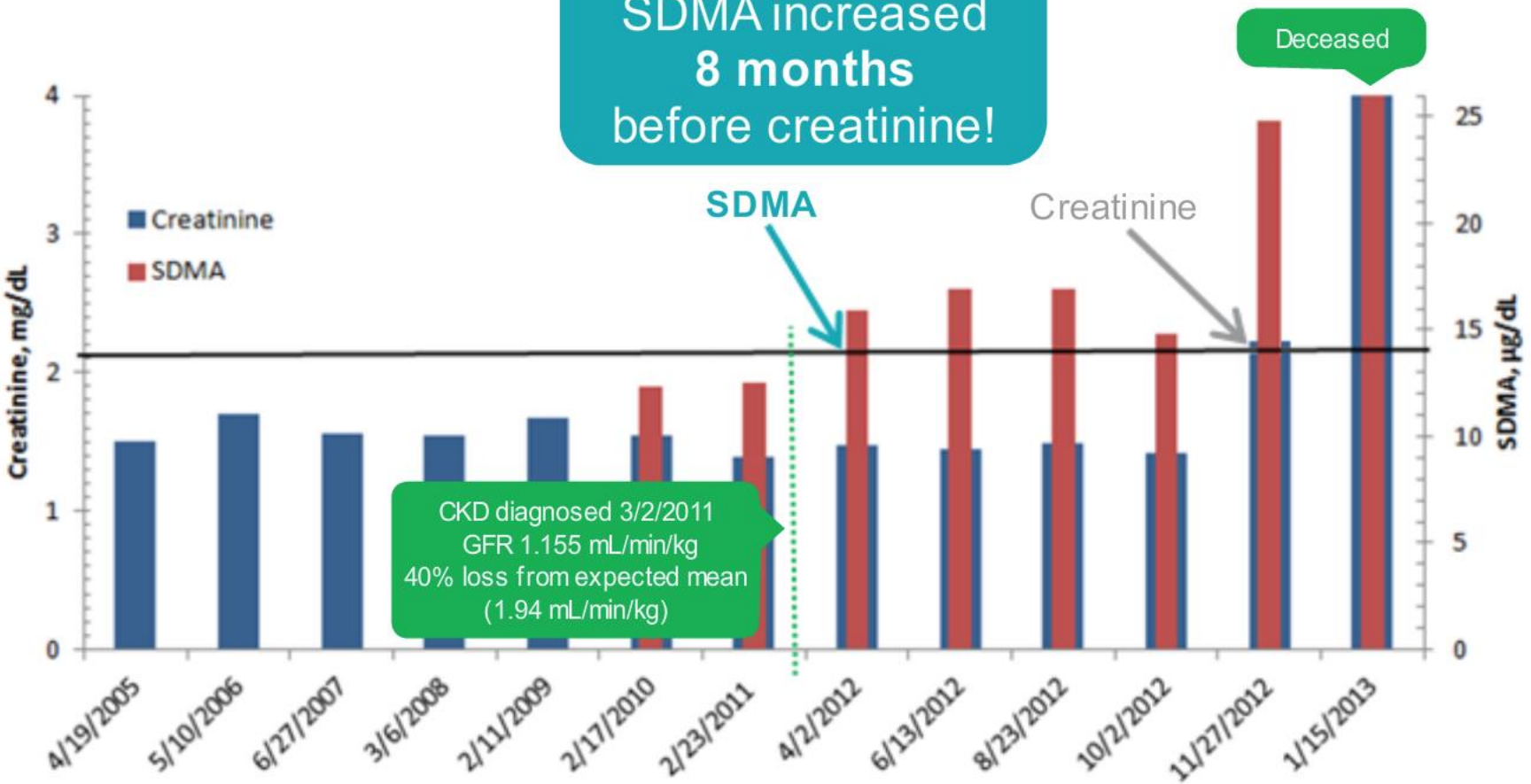
Reference

Hall JA, Yerramilli M, Obare E, Yerramilli M, Jewell DE. Comparison of serum concentrations of symmetric dimethylarginine and creatinine as kidney function biomarkers in cats with chronic kidney disease. J *Vet Intern Med. 2014;28(6):1676–1683.*

Reference

Braff J, Obare E, Yerramilli M, Elliott J, Yerramilli M. Relationship between serum symmetric dimethylarginine concentration and glomerular filtration rate in cats. *J Vet Intern Med.* 2014;28(6):1699–1701.

In this case, SDMA increased **8 months** before creatinine!



JA Hall, et al. JVIM 2014

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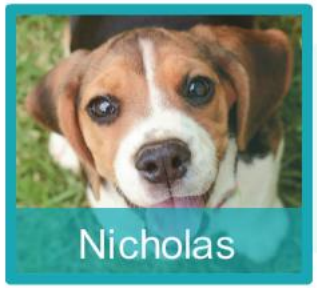

Deceased

SDMA

Creatinine

Creatinine [mg/dL]

SDMA [µg/dL]

Creatinine, mg/dL

SDMA, µg/dL

3.00

2.00

1.00

0.00

20

10

0

CKD diagnosed Feb. 2010
GFR 1.451 mL/min/kg
67% loss from expected
mean (4.38 mL/min/kg)

In this case,
SDMA increased
19 months
before creatinine!

10/23/2007

1/2/2008

2/7/2008

9/3/2009

8/18/2010

1/11/2011

4/12/2011

10/4/2011

12/7/2011

1/26/2012

2/3/2012

M.B. Nabity JVIM 2014

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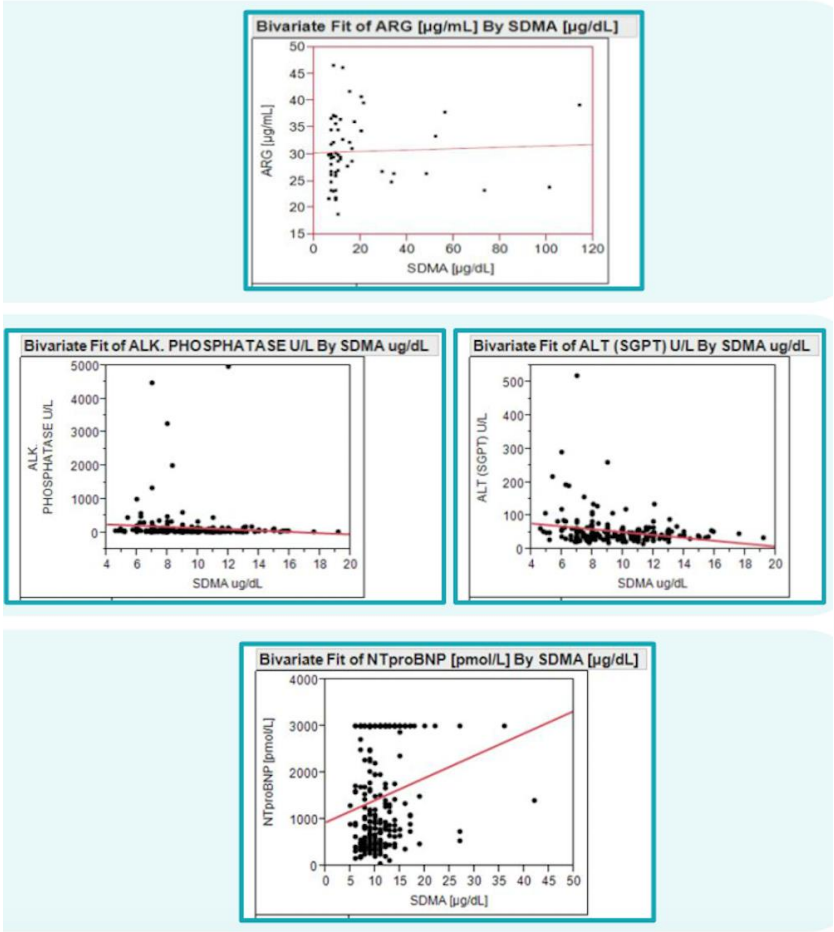
SDMA 不受其他因子影響

- 血清中Arginine 含量
- 飲食

- 肝臟疾病
- 肝指數

- 心臟疾病

- 發炎反應
- 糖尿病



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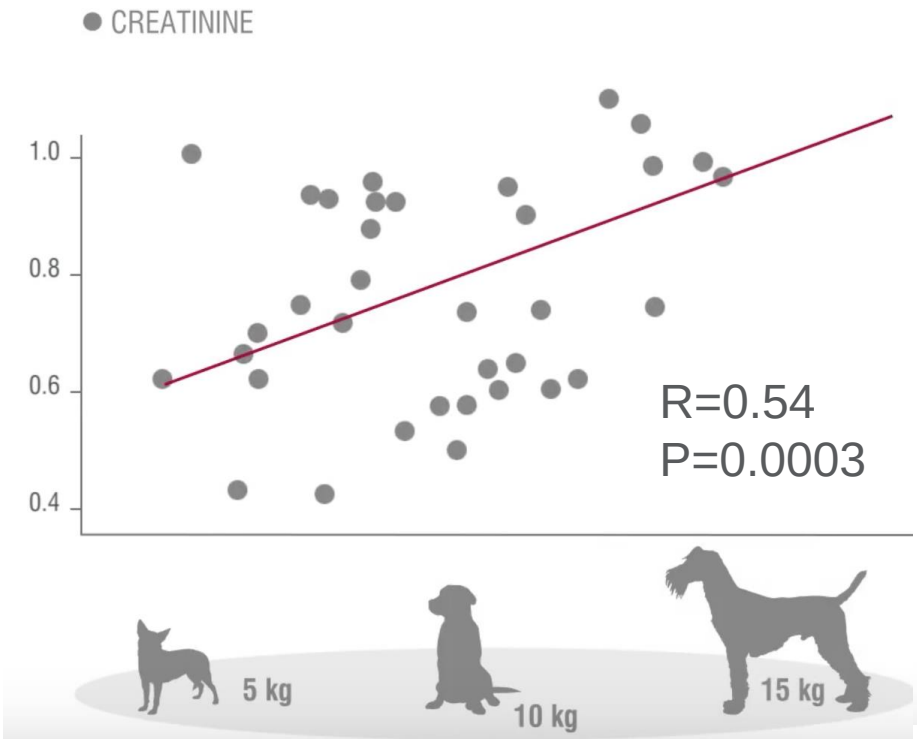
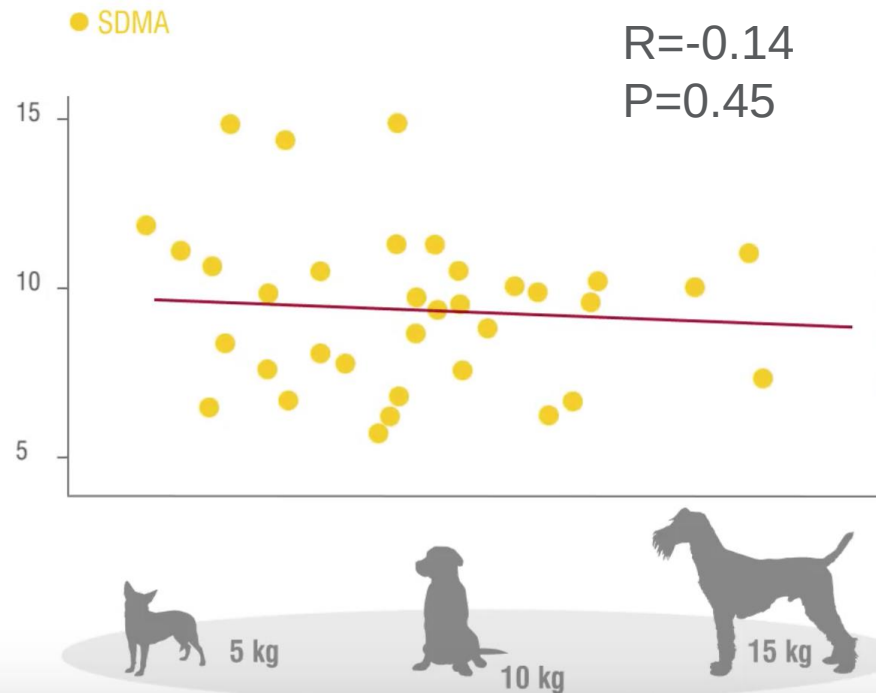
SDMA 不像Cre受肌肉影響





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Biomarker for kidney function

- SDMA is excreted by the kidneys.
- SDMA highly correlates with gromerular filtration rate (GFR).

Increases earlier than creatinine

- SDMA increases with on average 40% loss and as little as 25% loss of kidney function; however, creatinine increases when up to 75% loss of kidney function.

Specific for kidney function

- SDMA is not impacted by external factors.
- SDMA is not impacted by lean body mass.

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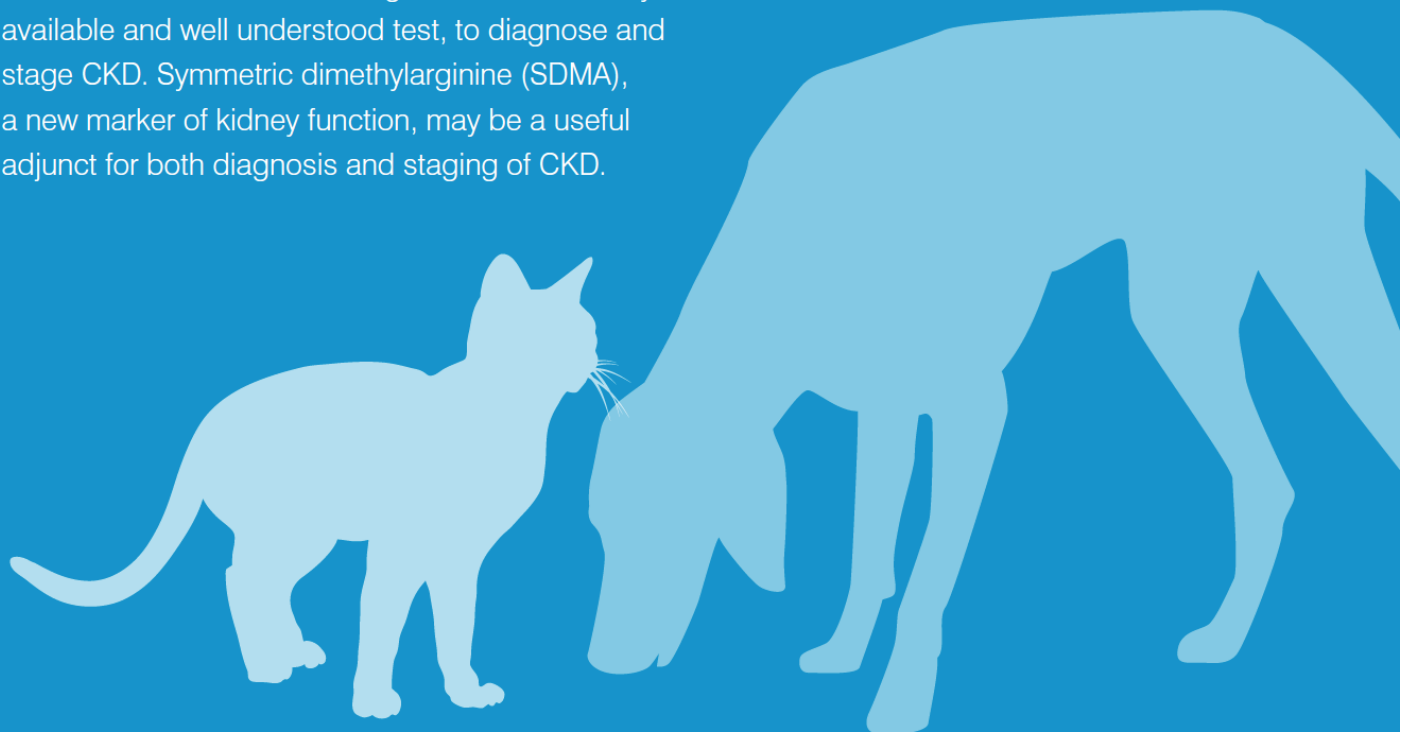
有了工具，準備上戰場

IRIS International Renal Interest Society

Diagnosing, Staging, and Treating Chronic Kidney Disease in Dogs and Cats

Chronic kidney disease (CKD) is diagnosed based on evaluation of all available clinical and diagnostic information in a stable patient. The IRIS Board continues to recommend using creatinine, a widely available and well understood test, to diagnose and stage CKD. Symmetric dimethylarginine (SDMA), a new marker of kidney function, may be a useful adjunct for both diagnosis and staging of CKD.



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Case 1 小鳳

- 11y/o FS DSH
- History: idiopathic feline hepatic lipidosis 四年前
- Normal ASUD
- 想做年度健檢

- BE: BCS: 5/9, NSF

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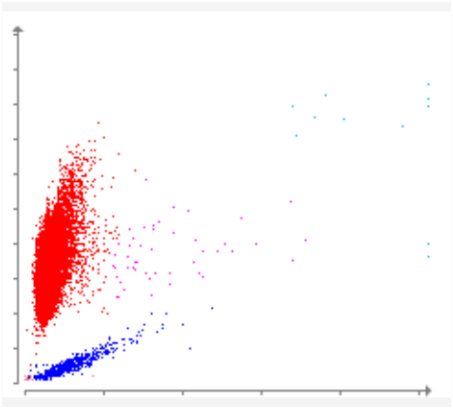
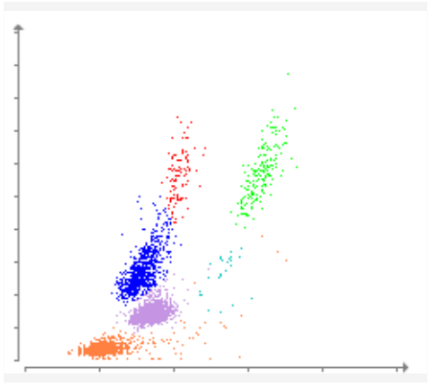
5/3/18 11:45 AM

TEST	RESULT	REFERENCE VALUE
RBC	9.61	6.54 - 12.2 M/µL
Hematocrit	38.2	30.3 - 52.3 %
Hemoglobin	12.8	9.8 - 16.2 g/dL
MCV	39.8	35.9 - 53.1 fL
MCH	13.3	11.8 - 17.3 pg
MCHC	33.5	28.1 - 35.8 g/dL
RDW	**27.2**	**15.0 - 27.0 %**
% Reticulocyte	0.2	%
Reticulocyte	17.3	3 - 50 K/µL
WBC	3.91	2.87 - 17.02 K/µL
% Neutrophil	67.2	%
% Lymphocyte	24.6	%
% Monocyte	2.8	%
% Eosinophil	4.6	%
% Basophil	0.8	%
Neutrophil	2.63	1.48 - 10.29 K/µL
Lymphocyte	0.96	0.92 - 6.88 K/µL
Monocyte	0.11	0.05 - 0.67 K/µL
Eosinophil	0.18	0.17 - 1.57 K/µL
Basophil	0.03	0.01 - 0.26 K/µL
Platelet	287	151 - 600 K/µL
MPV	15.1	11.4 - 21.6 fL
Plateletcrit	0.43	0.00 - 0.79 %





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Chemistry

	5/3/18 11:58 AM	
Glucose	119	71 - 159 mg/dL
Creatinine	1.9	0.8 - 2.4 mg/dL
BUN	22	16 - 36 mg/dL
BUN: Creatinine Ratio	12	
Phosphorus	3.3	3.1 - 7.5 mg/dL
Calcium	9.3	7.8 - 11.3 mg/dL
Sodium	158	150 - 165 mmol/L
Potassium	3.9	3.5 - 5.8 mmol/L
Na: K Ratio	40	
Chloride	119	112 - 129 mmol/L
Total Protein	7.3	5.7 - 8.9 g/dL
Albumin	3.0	2.3 - 3.9 g/dL
Globulin	4.3	2.8 - 5.1 g/dL
Albumin: Globulin Ratio	0.7	
ALT	30	12 - 130 U/L
ALP	29	14 - 111 U/L
GGT	0	0 - 4 U/L
Bilirubin - Total	0.2	0.0 - 0.9 mg/dL
Cholesterol	98	65 - 225 mg/dL
Osmolality	316	mmol/kg

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Chemistry

5/3/18
9:49 PM

IDEXX SDMA Learn More	b **20**	0 - 14 µg/dL	

b **SDMA：**

如果 SDMA 及肌酸酐 (Creatinine) 兩者都落在參考區間內，那麼腎臟功能則可能是良好的。請評估完整的尿液分析並確認這裡沒有任何其他腎臟疾病的證據。
如果 SDMA 升高，但是肌酸酐卻落在參考區間內。SDMA 檢測相較於肌酸酐是一種更敏銳的腎臟功能指標，因為 SDMA 早期偵測腎臟功能下降，且不受肌肉發達影響。肌酸酐可能錯失早期功能喪失，且在肌肉不發達的患病動物中錯誤減少。SDMA 在急性和主動性損傷，以及慢性腎臟病中增加。應該進行一個完整的尿液分析以評估不當比重、蛋白尿及其他腎臟疾病的證據。有關建議行動的資訊，請瀏覽 idexx.com/SDMAalgorithm。
如果 SDMA 落在參考區間內並且肌酸酐值是升高的。這種結果組合不常見。SDMA 和肌酸酐可能同時受生物及檢測變異性影響，導致在參考區間上限附近波動；這可在管理良好的穩定慢性腎臟病發現，且結果可能與疾病惡化一致。肝臟功能正常、肌肉發達的狗，其肌酸酐值可能會超過參考區間值。肌酸酐可在餐後人為增加。如果仍懷疑有腎臟疾病，應該於所有患病動物進行一個完整的尿液分析以評估不當比重、蛋白尿或其他腎臟疾病的證據。
如果 SDMA 及肌酸酐兩者都呈現升高狀態，那麼可能有腎臟疾病且應採取行動。應該進行一個完整的尿液分析以評估不當尿比重、蛋白尿或其他腎臟疾病的證據。有關建議行動的資訊，請瀏覽 idexx.com/SDMAalgorithm。

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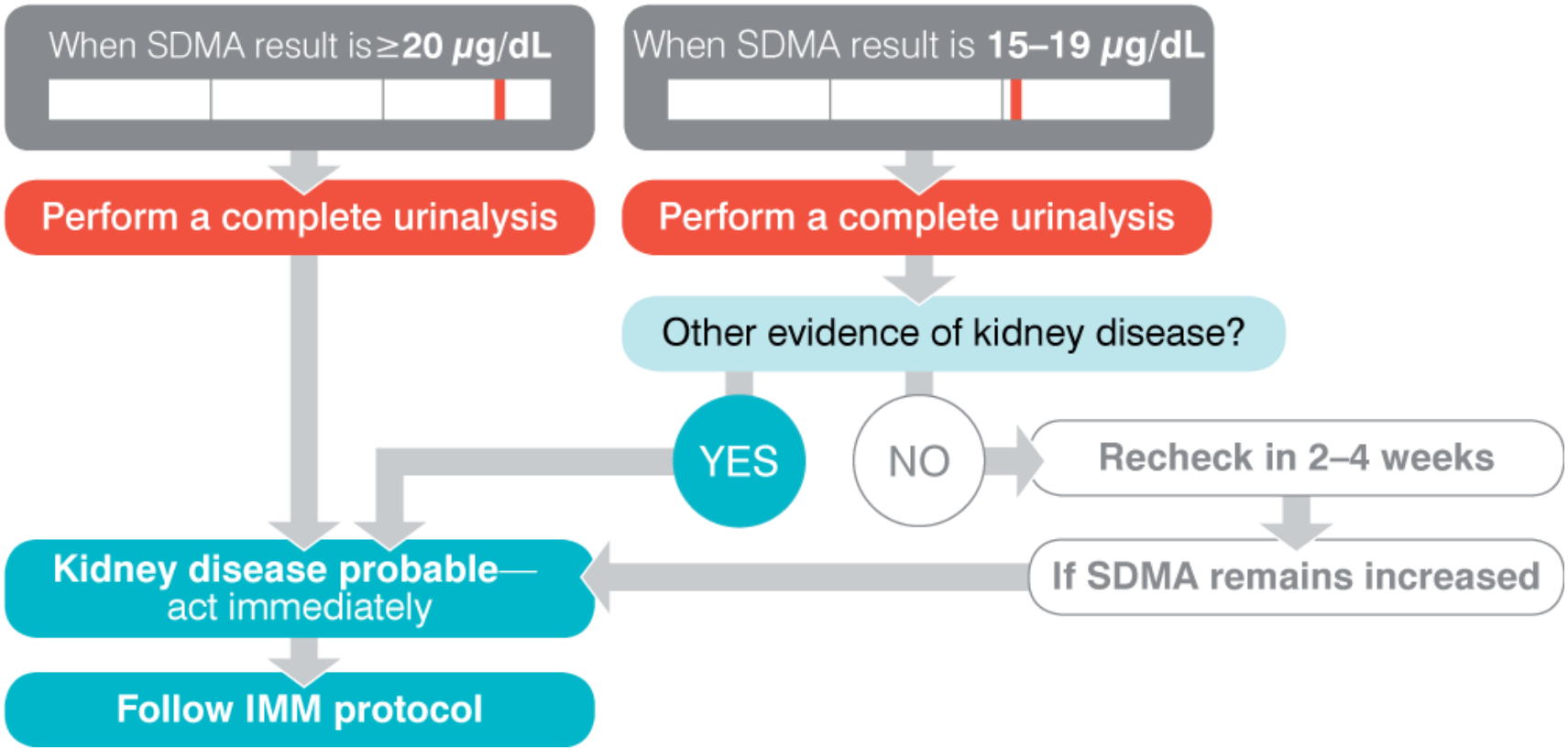
下一步該怎麼做?



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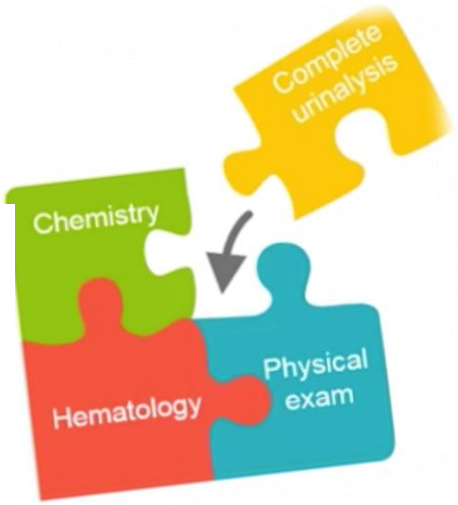
Urinalysis

5/3/18 11:44 AM

TEST	RESULT
Collection	Cystocentesis
Color	Pale Yellow
Clarity	Clear
Specific Gravity	1.023
pH	6.5
Urine Protein	neg
Glucose	neg
Ketones	neg
Blood / Hemoglobin	250
Bilirubin	neg
Urobilinogen	norm



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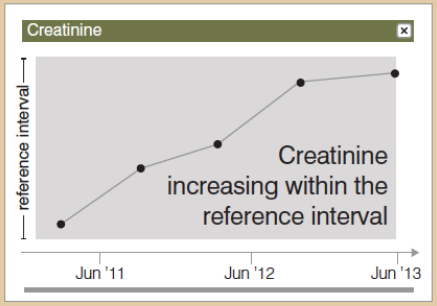
To diagnose early CKD

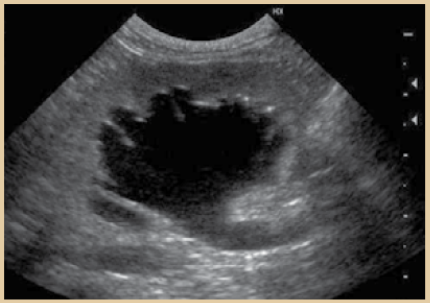
One or more of these diagnostic findings

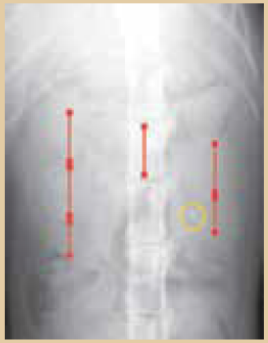
1



2 **Persistent increased SDMA >14 µg/dL**

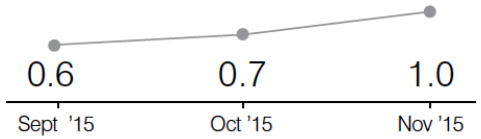
3 **Abstract kidney imaging**





4 **Persistent renal proteinuria**

UPC >0.5 in dogs; UPC >0.4 in cats



Urine protein to creatinine (UPC) ratio

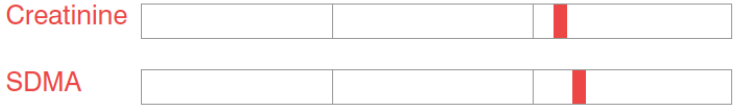
OR

To diagnose more advanced CKD

Both of these diagnostic findings

1

Increased creatinine and SDMA concentrations



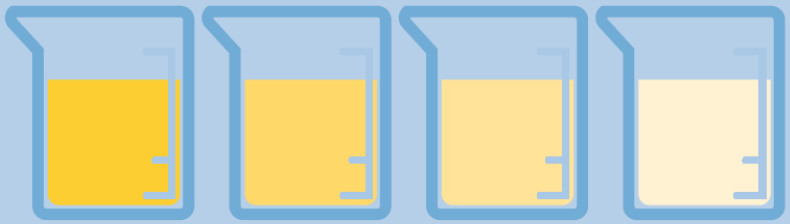
Results of both tests should be interpreted in light of patient's hydration status.

plus

2

Urine specific gravity **<1.030**

Urine specific gravity **<1.035**



1.030	Canine	1.008
1.035	Feline	1.008

早期腎臟疾病診斷的下一步

Investigate

To identify an underlying cause, perform:

- Urine culture and MIC susceptibility
- Infectious disease testing (Lyme disease, leptospirosis, ehrlichiosis, FeLV, FIV, FIP, toxoplasmosis)
- Diagnostic imaging (stones, pyelonephritis)
- History/possibility of toxin exposure?
- History/exposure to potentially nephrotoxic drugs?

For confounding conditions, assess:

- Hydration status
- Blood pressure
- Urine protein:creatinine ratio
- Thyroid status

Manage

Treat appropriately

- Underlying disease if identified
- Clinical dehydration
- Persistent hypertension
- Persistent proteinuria
- Hyperthyroidism

Provide kidney support immediately

- Feed kidney-supportive diet
- Provide fresh, clean water sources
- Discontinue all potentially nephrotoxic drugs if possible

Adjust anesthesia protocols

- Provide intravenous fluids, before, during, and upon recovery
- Provide oxygen, before, during, and upon recovery
- Maintain and monitor blood pressure and body temperature
- If needed, use narcotic for pain management

Monitor

Underlying or confounding disease identified

Monitor as indicated

Underlying or confounding disease not identified

Recheck in 2 weeks

SDMA returns to normal

- Kidney function has returned to normal
- Monitor confounding conditions and other underlying disease if present

SDMA remains increased but stable

- If SDMA and creatinine are stable, chronic kidney disease (CKD) is diagnosed
- Initiate appropriate treatment based on International Renal Interest Society (IRIS) CKD staging

SDMA continues to increase

- If SDMA and/or creatinine are increasing, consider ongoing, active kidney injury
- Perform additional diagnostics to determine cause and to guide treatment

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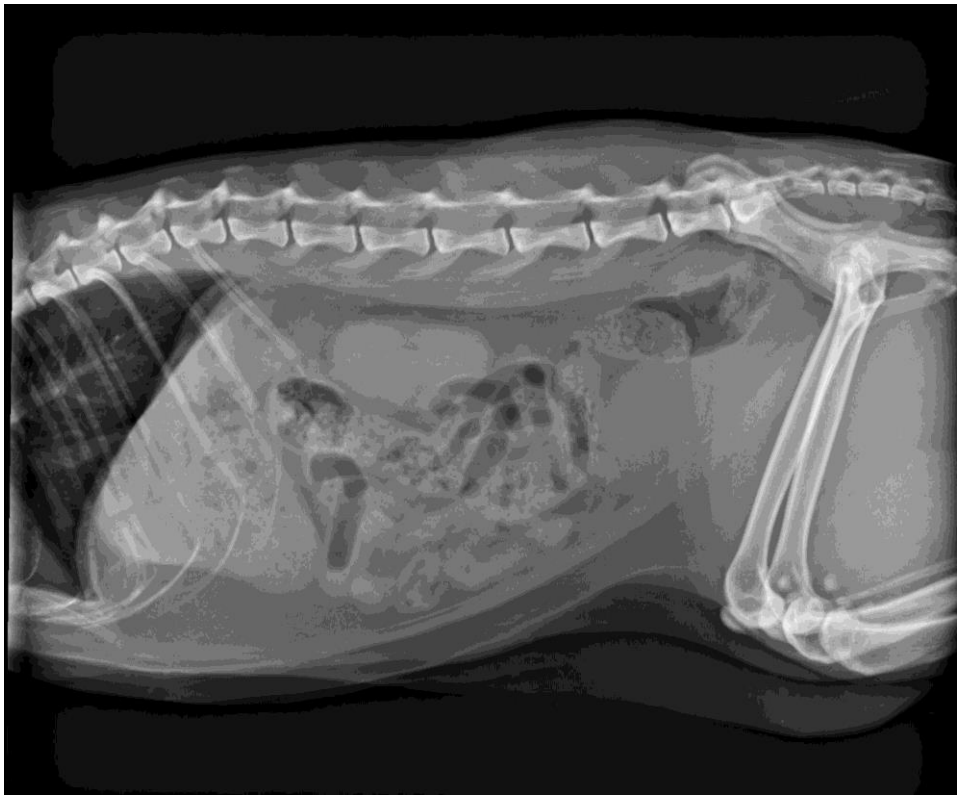

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Chemistry	6/26/18 10:41 AM		
IDEXX SDMA Learn More	[a] 17	0 - 14 µg/dL	
Creatinine	1.7	0.8 - 2.4 mg/dL	
BUN	20	16 - 36 mg/dL	
BUN: Creatinine Ratio	11		
Phosphorus	3.7	3.1 - 7.5 mg/dL	

[a] **SDMA：**

如果 SDMA 升高，但是肌酸酐卻落在參考區間內。SDMA 檢測相較於肌酸酐是一種更敏銳的腎臟功能指標，因為 SDMA 早期偵測腎臟功能下降，且不受肌肉發達影響。肌酸酐可能錯失早期功能喪失，且在肌肉不發達的患病動物中錯誤減少。SDMA 在急性和主動性損傷，以及慢性腎臟病中增加。應該進行一個完整的尿液分析以評估不當比重、蛋白尿及其他腎臟疾病的證據。有關建議行動的資訊，請瀏覽 idexx.com/SDMAalgorithm。

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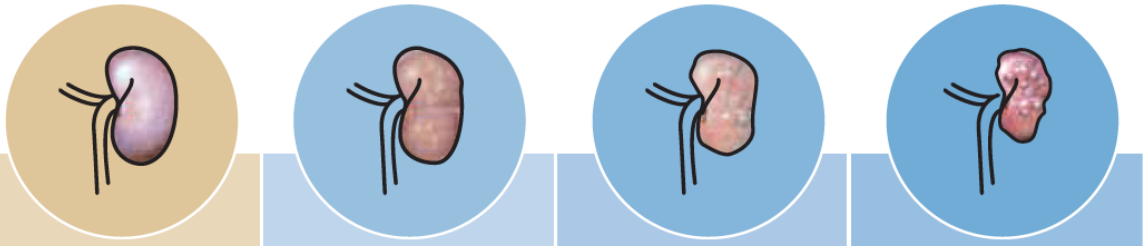
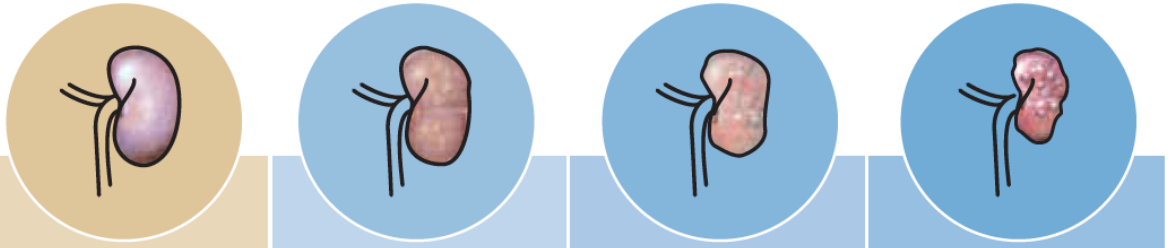
Step 2: Stage CKD



	Stage 1 No azotemia	Stage 2 Mild	Stage 3 Moderate	Stage 4 Severe
Creatinine in mg/dL				
Stage based on stable creatinine — Canine	<1.4	1.4–2.0	2.1–5.0	>5.0
Stage based on stable creatinine — Feline	<1.6	1.6–2.8	2.9–5.0	>5.0
SDMA in µg/dL	>14	>14	Moderately increased	Markedly increased
Consider understaged based on creatinine		≥25		
Consider understaged based on creatinine			≥45	
UPC ratio — Substage based on proteinuria — Canine	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.5**	Proteinuric **>0.5**	
UPC ratio — Substage based on proteinuria — Feline	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.4**	Proteinuric **>0.4**	
Systolic blood pressure in mm Hg — Substage based on blood pressure	Normotensive **<150**	Borderline hypertensive **150–159**	Hypertensive **160–179**	Severely hypertensive **≥180**

© 201

Step 3: Treat CKD



Stage 1
No azotemia

- Investigate for and treat underlying disease
- Treat hypertension if systolic blood pressure persistently >160 or evidence of end-organ damage
- Treat persistent proteinuria with therapeutic diet and medication (UPC >0.5 in dogs; UPC >0.4 in cats)
- Keep phosphorus <4.6 mg/dL
- If required, use kidney therapeutic diet +/– phosphate binder
- Use with caution potentially nephrotoxic drugs
- Correct prerenal and postrenal abnormalities
- Fresh water available at all times

Stage 2
Mild

- Same as Stage 1
- Kidney therapeutic diet
- Treat hypokalemia in cats
- Treat metabolic acidosis
- If SDMA ≥25, consider treatment for Stage 3

Stage 3
Moderate

- Same as Stage 2
- Keep phosphorus <5.0 mg/dL
- Treat anemia (PCV <25% in dogs; PCV <20% in cats)
- Treat vomiting/inappetence/nausea
- Consider subcutaneous and/or enteral fluids to maintain hydration
- Consider calcitriol therapy in dogs
- If SDMA ≥45, consider treatment for Stage 4

Stage 4
Severe

- Same as Stage 3
- Keep phosphorus <6.0 mg/dL
- Consider feeding tube for nutritional and hydration support and for ease of medicating

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處方食品® k/d ® Early Support 貓糧

蛋白質上升14%
(k/d:30.1% vs early k/d:34%)
必需氨基酸比例：AAFCO 160%
Omega 3, L-carnitine
二個月回診追蹤

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小鳳 小總結

- Cre 正常， SDMA 上升

- 搭配完整尿檢
- SDMA早期診斷腎臟疾病（25-40%)

- Early chronic kidney disease!

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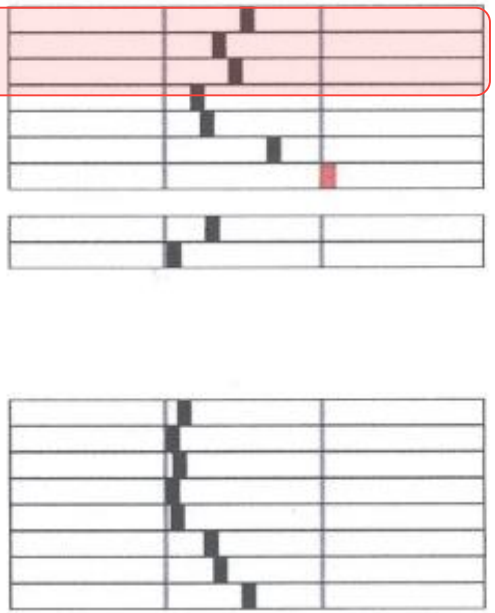
回顧小鳳的故事...

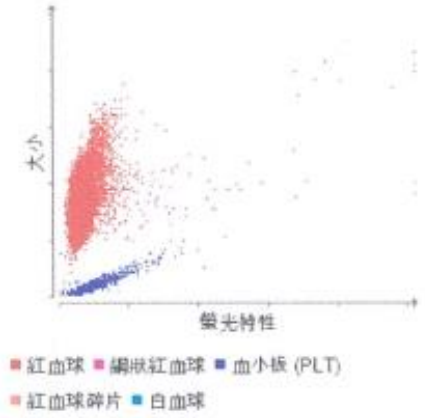
Case 1 小鳳 回顧

全血球細胞計數

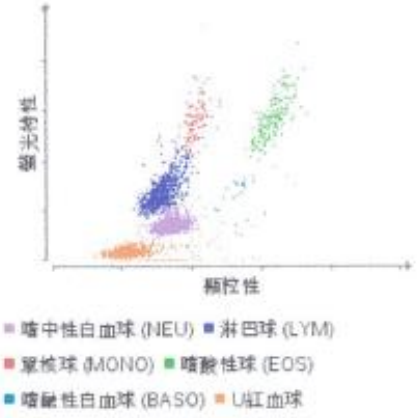
檢驗項目	檢驗結果	參考區間	低	參考範圍	高
ProCyte Dx (2018年5月3日 上午 11:45)					
RBC	9.61 M/μL	6.54 - 12.20			
HCT	38.2 %	30.3 - 52.3			
HGB	12.8 g/dL	9.8 - 16.2			
MCV	39.8 fL	35.9 - 53.1			
MCH	13.3 pg	11.8 - 17.3			
MCHC	33.5 g/dL	28.1 - 35.8			
RDW	27.2 %	15.0 - 27.0	高		
%RETIC	0.2 %				
RETIC	17.3 K/μL	3.0 - 50.0			
WBC	3.91 K/μL	2.87 - 17.02			
%NEU	67.2 %				
%LYM	24.6 %				
%MONO	2.8 %				
%EOS	4.6 %				
%BASO	0.8 %				
NEU	2.63 K/μL	1.48 - 10.29			
LYM	0.96 K/μL	0.92 - 6.88			
MONO	0.11 K/μL	0.05 - 0.67			
EOS	0.18 K/μL	0.17 - 1.57			
BASO	0.03 K/μL	0.01 - 0.26			
PLT	287 K/μL	151 - 600			
MPV	15.1 fL	11.4 - 21.6			
PCT	0.43 %	0.00 - 0.79			



紅血球測試



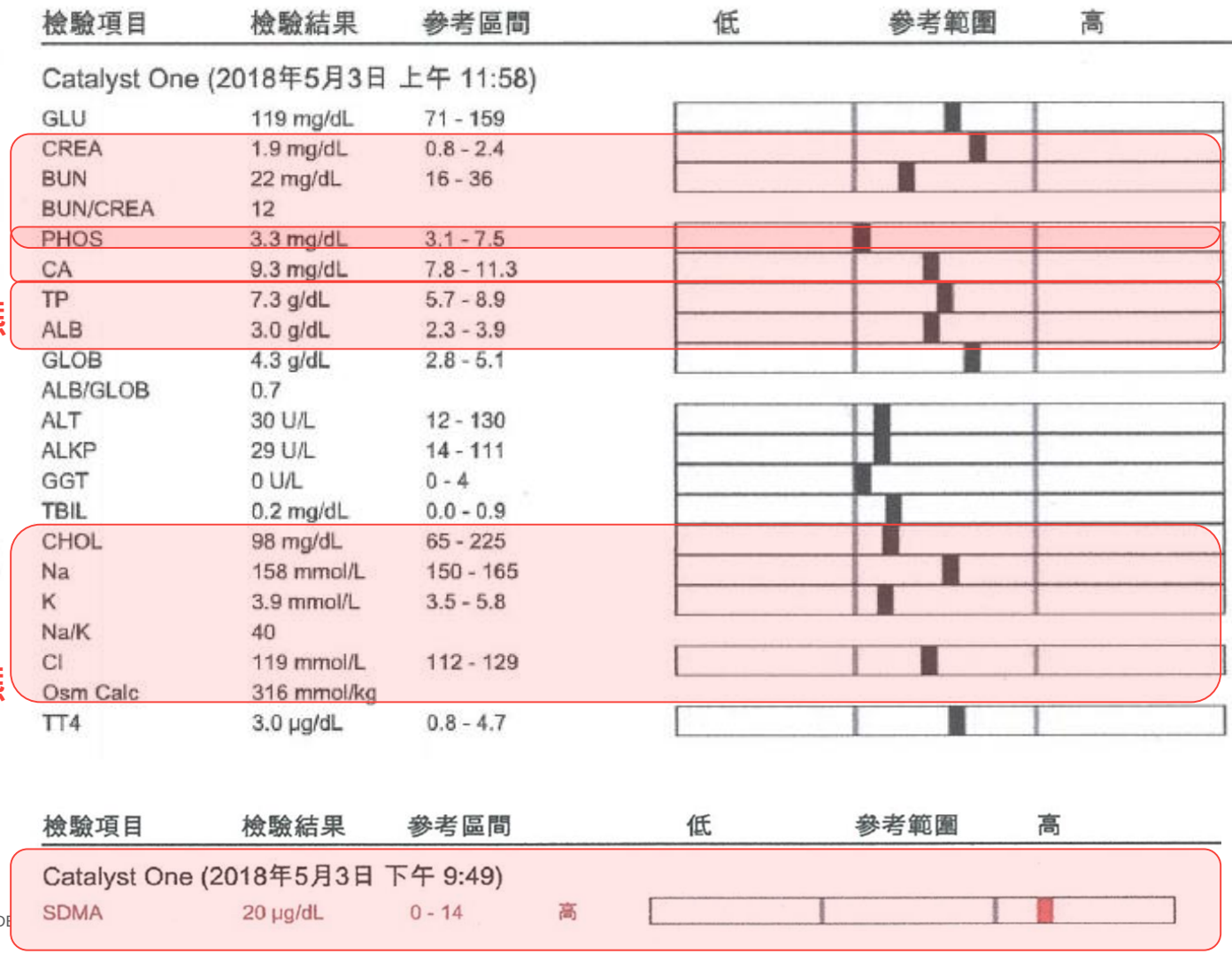
白血球測試



無貧血
水合狀態正常

Case 1 小鳳 回顧

血漿生化學檢查 (Chem 15套組 + 電解質 + TT4)



檢驗項目	檢驗結果	參考區間	低	參考範圍	高
Catalyst One (2018年5月3日 上午 11:58)					
GLU	119 mg/dL	71 - 159			
CREA	1.9 mg/dL	0.8 - 2.4			
BUN	22 mg/dL	16 - 36			
BUN/CREA	12				
PHOS	3.3 mg/dL	3.1 - 7.5			
CA	9.3 mg/dL	7.8 - 11.3			
TP	7.3 g/dL	5.7 - 8.9			
ALB	3.0 g/dL	2.3 - 3.9			
GLOB	4.3 g/dL	2.8 - 5.1			
ALB/GLOB	0.7				
ALT	30 U/L	12 - 130			
ALKP	29 U/L	14 - 111			
GGT	0 U/L	0 - 4			
TBIL	0.2 mg/dL	0.0 - 0.9			
CHOL	98 mg/dL	65 - 225			
Na	158 mmol/L	150 - 165			
K	3.9 mmol/L	3.5 - 5.8			
Na/K	40				
Cl	119 mmol/L	112 - 129			
Osm Calc	316 mmol/kg				
TT4	3.0 µg/dL	0.8 - 4.7			

檢驗項目	檢驗結果	參考區間		低	參考範圍	高
Catalyst One (2018年5月3日 下午 9:49)						
SDMA	20 µg/dL	0 - 14	高			

GFR

腎小管

水合狀態

腎病

腎病

腎小管

水合狀態

GFR

腎功能相關指數

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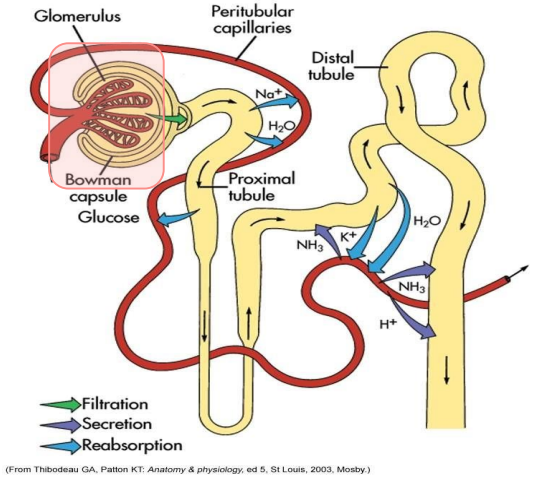
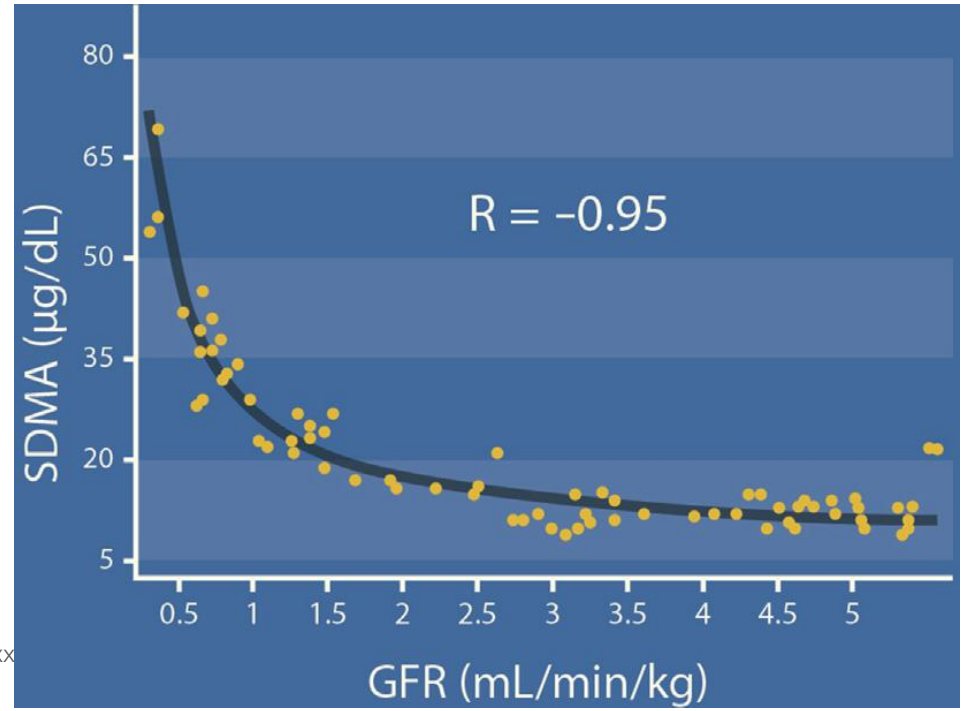
腎功能評估: Glomerular filtration rate (GFR)

- **BUN,CREA 是GFR的 晚期指標 (>75% 功能喪失)**
- **SDMA 是 更敏感的 GFR 指標**



SDMA ➔ 腎病 早期指標

(25 ~ 40 % 腎功能喪失)



Relford et al. Symmetric DimethylargininеImproving the Diagnosis and Staging of Chronic Kidney Disease in Small Animals. Vet Clin Small Anim 46 (2016) 941–960.

Fig. 2. Serum SDMA correlates with decreasing GFR by iohexol clearance in affected male dogs with XLHN (R 5 0.95). (From Nabity NB, Lees GE, Boggess MM, et al. Symmetric dimethylarginine assay validation, stability, and evaluation as a marker for the detection of chronic kidney disease in dogs. J Vet Intern Med 2015;29:1040; with permission.)

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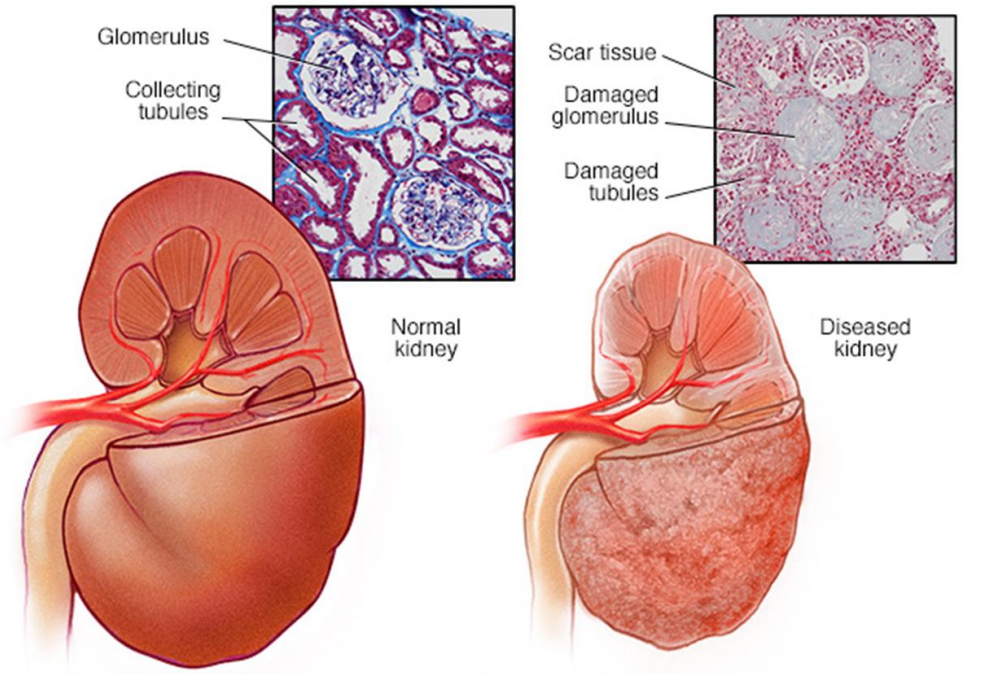
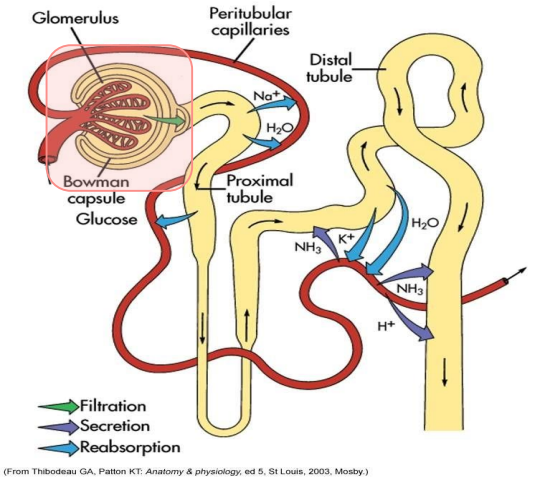
研究顯示:

在患有慢性腎病的貓，血中SDMA比CREA平均提早了17個月 (1.5 – 48個月) 升高。

Comparison of Serum Concentrations of Symmetric Dimethylarginine and Creatinine as Kidney Function Biomarkers in Cats with Chronic Kidney Disease

Journal of Veterinary Internal Medicine
Volume 28, Issue 6, pages 1676-1683, 17 SEP 2014 DOI: 10.1111/jvim.12445
http://onlinelibrary.wiley.com/doi/10.1111/jvim.12445/full#jvim12445-fig-0002





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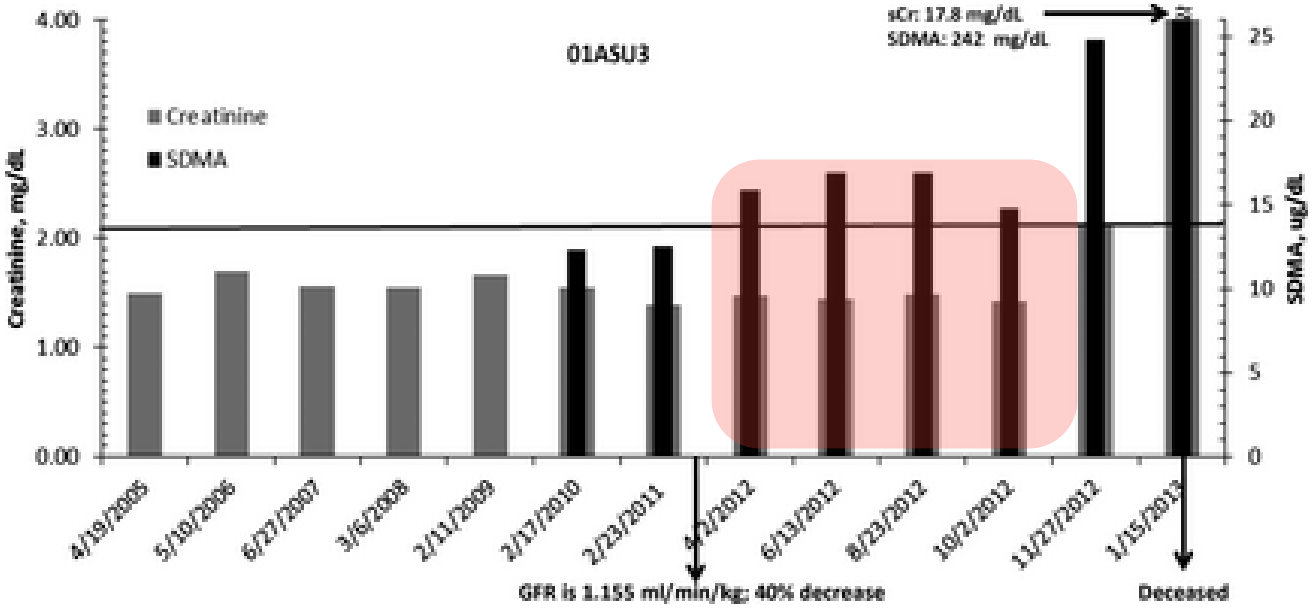
以此慢性腎病的貓為例:
血中SDMA升高比CREA早了八個月發生。

Comparison of Serum Concentrations of Symmetric Dimethylarginine and Creatinine as Kidney Function Biomarkers in Cats with Chronic Kidney Disease



Representative cat (01ASU3; born September 2001; neutered male) with serum symmetric dimethylarginine (SDMA; black bars) and sCr (gray bars) concentrations indicated across time. Glomerular filtration rate was measured in March 2011 and found to be 40% below the mean of 1.94 mL/min/kg for the feline population of the reference laboratory. Serum SDMA was increased in April 2012 (16 µg/dL). The cat became azotemic in November 2012 (sCr, 2.12 mg/dL), approximately 8 months after serum SDMA was increased. The cat died in January 2013.

Journal of Veterinary Internal Medicine
Volume 28, Issue 6, pages 1676-1683, 17 SEP 2014 DOI: 10.1111/jvim.12445
http://onlinelibrary.wiley.com/doi/10.1111/jvim.12445/full#jvim12445-fig-0002

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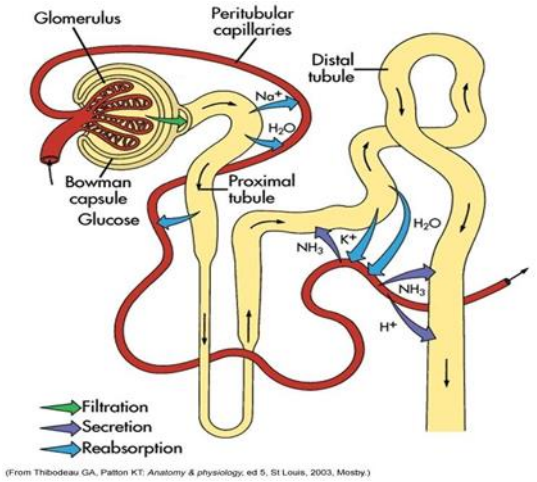
Case 1 小鳳 回顧

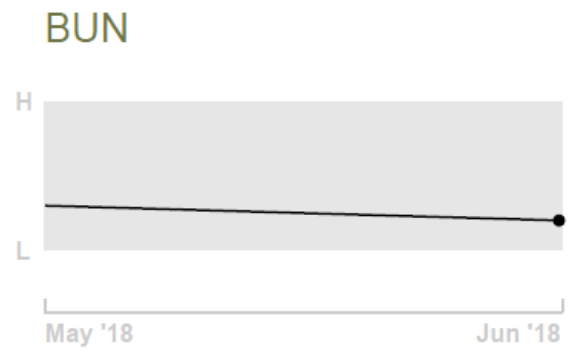
- 當GFR減少，血中SDMA 升高

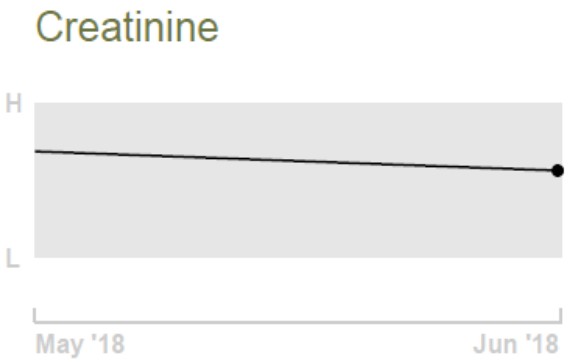
- GFR減少，要考慮到兩種情況:
  - 1. 腎臟血液灌流不足 (循環的問題, ex. 脫水)
  - 2. 功能腎元不足 (ex. 腎臟疾病)

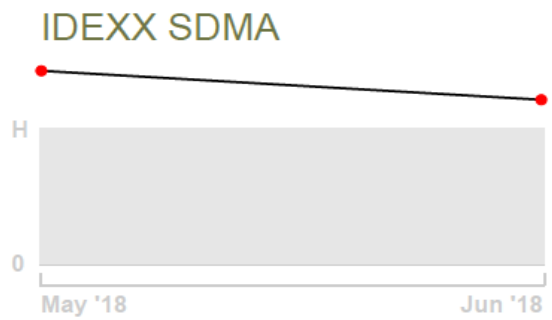


臨床意義	指數	1. 腎灌流不足 (ex. 脫水)	2. 功能腎元不足 (ex. 腎臟疾病)
GFR 狀態	BUN, Crea, SDMA	↑ (GFR減少)	↑ (GFR減少)
腎小管 尿濃縮能力	尿比重 (USG)	↑	↓
水合狀態	TP, ALB, Hct Na, Cl	↑	不一定

Case 1 小鳳 回顧







- 臨床上沒有症狀
- 11歲齡貓
- 一個月的觀察，追蹤GFR相關指數
- 確定不是脫水，而是早期的慢性腎病

	5/3/18 11:44 AM	
Collection	Cystocentesis	
Color	Pale Yellow	
Clarity	Clear	
Specific Gravity	1.023	
pH	6.5	
Urine Protein	neg	
Glucose	neg	
Ketones	neg	
Blood / Hemoglobin	250	Ery/µL
Bilirubin	neg	
Urobilinogen	norm	

不適當濃縮的尿液
(USG 正常應 > 1.035)

Case 1 小鳳 回顧

發現異常

May 3rd 2018

Jun 26 2018

定期追蹤

I: 調查
M: 調理
M: 追蹤

Diagnosed!!
確診 CKD

持續的SDMA > 14 ug/dL

根據 IRIS 分期進行治療
CKD Stage 2

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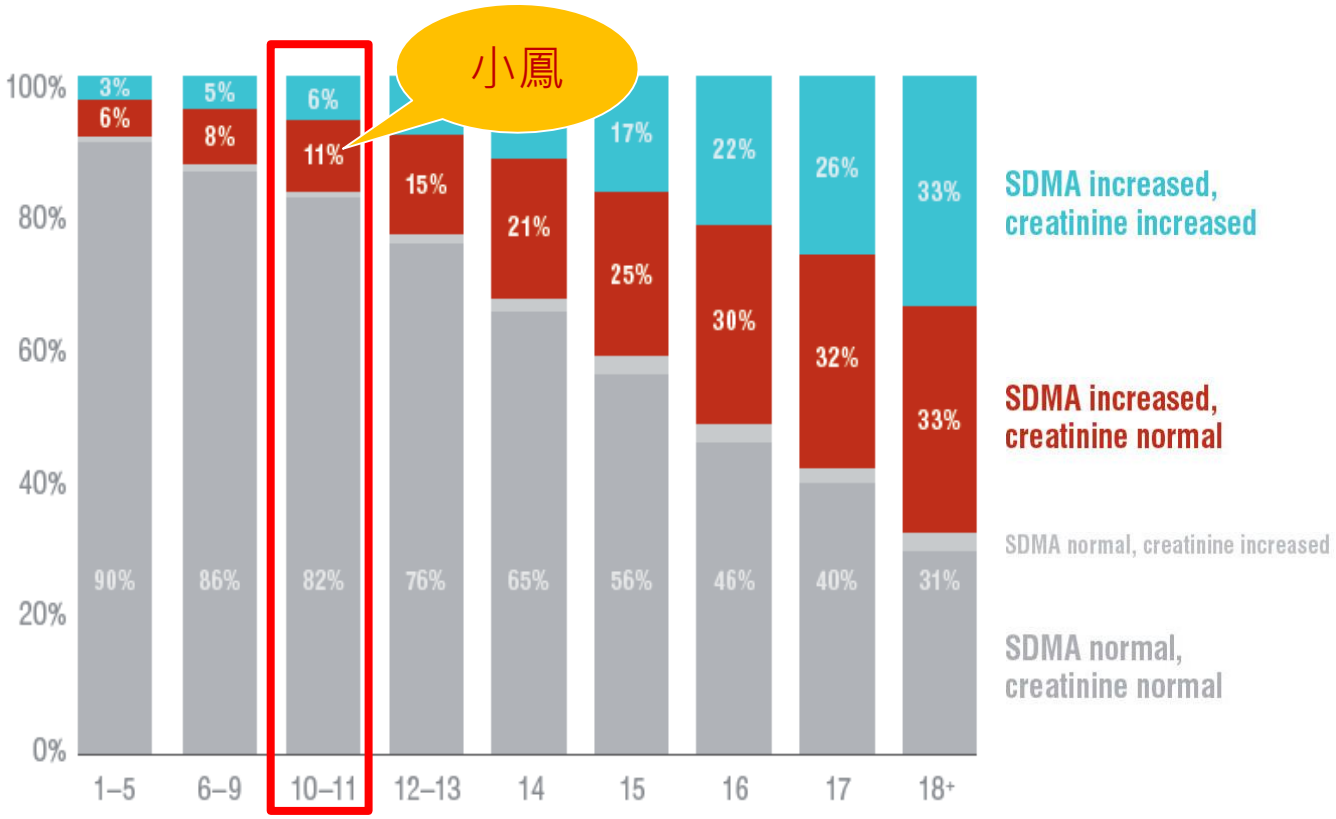
Case 1 小鳳 回顧

隨著寵物年齡增加，血中SDMA上升的比例也增高

Prevalence of kidney disease increases with age in cats (n = 250,329)



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Q&A

Case 2 多比

- 10 y/o 黃金獵犬 FS
- 因皮膚團塊，外科手術前麻醉評估
- Normal ASUD

- PE: pink MM, well-hydration
- 未空腹

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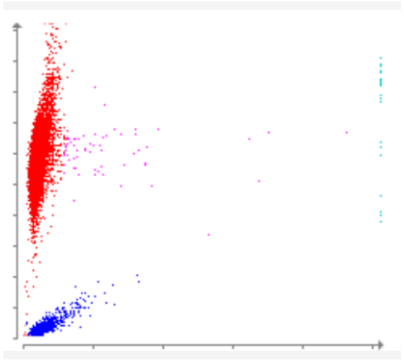
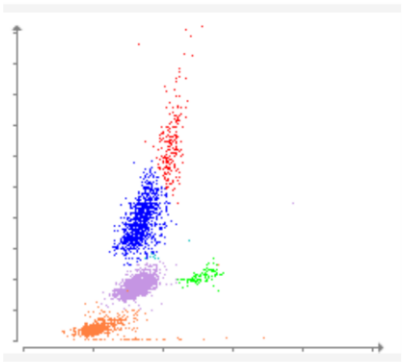
Hematology

4/24/18 7:34 PM

TEST	RESULT	REFERENCE VALUE
RBC	7.61	5.65 - 8.87 M/µL
Hematocrit	49.9	37.3 - 61.7 %
Hemoglobin	17.1	13.1 - 20.5 g/dL
MCV	65.6	61.6 - 73.5 fL
MCH	22.5	21.2 - 25.9 pg
MCHC	34.3	32.0 - 37.9 g/dL
RDW	19.6	13.6 - 21.7 %
% Reticulocyte	0.3	%
Reticulocyte	19	10 - 110 K/µL
WBC	**4.88**	**5.05 - 16.76 K/µL**
% Neutrophil	70.5	%
% Lymphocyte	22.3	%
% Monocyte	4.7	%
% Eosinophil	2.3	%
% Basophil	0.2	%
Neutrophil	3.44	2.95 - 11.64 K/µL
Lymphocyte	1.09	1.05 - 5.1 K/µL
Monocyte	0.23	0.16 - 1.12 K/µL
Eosinophil	0.11	0.06 - 1.23 K/µL
Basophil	0.01	0 - 0.1 K/µL
Platelet	303	148 - 484 K/µL
PDW	14.3	9.1 - 19.4 fL
MPV	10.5	8.7 - 13.2 fL
Plateletcrit	0.32	0.14 - 0.46 %



Download



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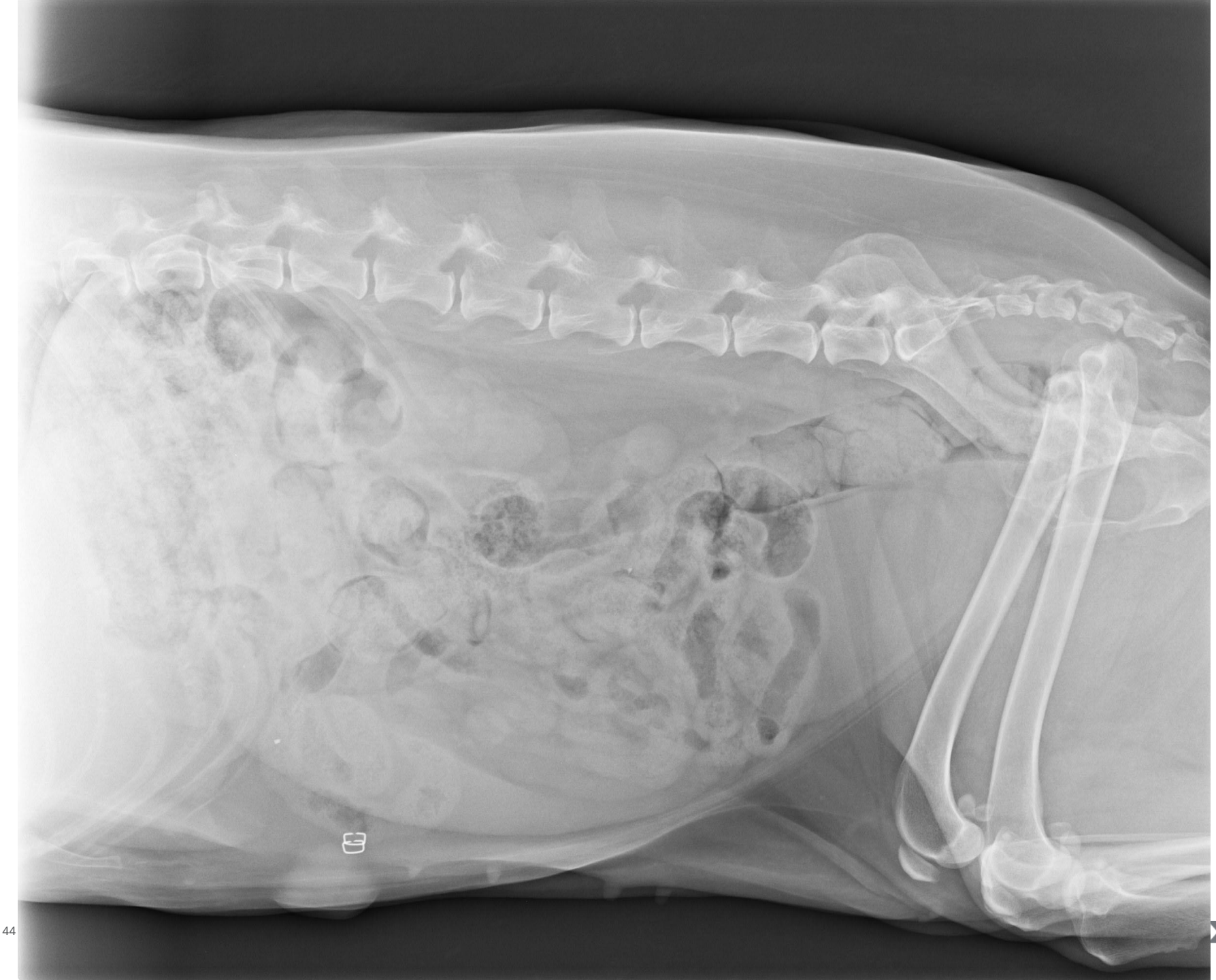
Chemistry	4/24/18 10:42 PM	4/24/18 7:42 PM	
Glucose		67	70 - 143 mg/dL
Creatinine	5.0	5.6	0.5 - 1.8 mg/dL
BUN		64	7 - 27 mg/dL
BUN: Creatinine Ratio		11	
Phosphorus	5.3		
Calcium	10.2		
Sodium		148	144 - 160 mmol/L
Potassium		4.1	3.5 - 5.8 mmol/L
Na: K Ratio		36	
Chloride		112	109 - 122 mmol/L
Total Protein		7.2	5.2 - 8.2 g/dL
Albumin		3.0	2.2 - 3.9 g/dL
Globulin		4.3	2.5 - 4.5 g/dL
Albumin: Globulin Ratio		0.7	
ALT		79	10 - 125 U/L
ALP		73	23 - 212 U/L



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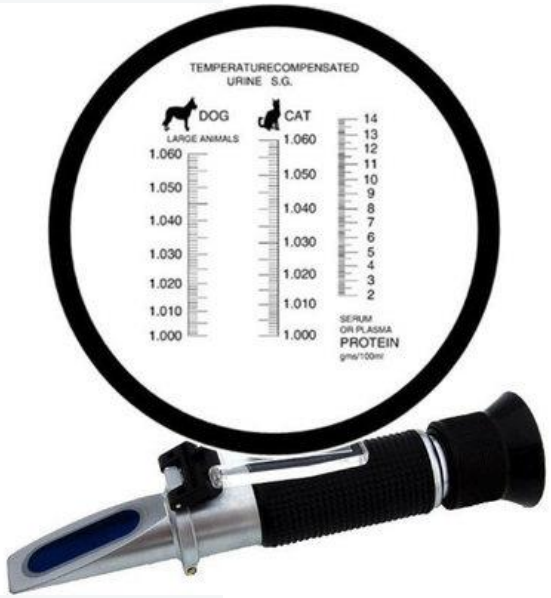
Urinalysis

4/24/18
9:00 PM

	Collection	Cystocentesis	
›	Color	Straw	
›	Clarity	Clear	
›	Specific Gravity	1.015	
›	pH	5.0	
›	Urine Protein	neg	
›	Glucose	neg	
›	Ketones	neg	
›	Blood / Hemoglobin	50	Ery/µL
›	Bilirubin	neg	
›	Urobilinogen	norm	
	Leukocyte Esterase	100	Leu/µL



Confirm all leukocyte results with microscopy

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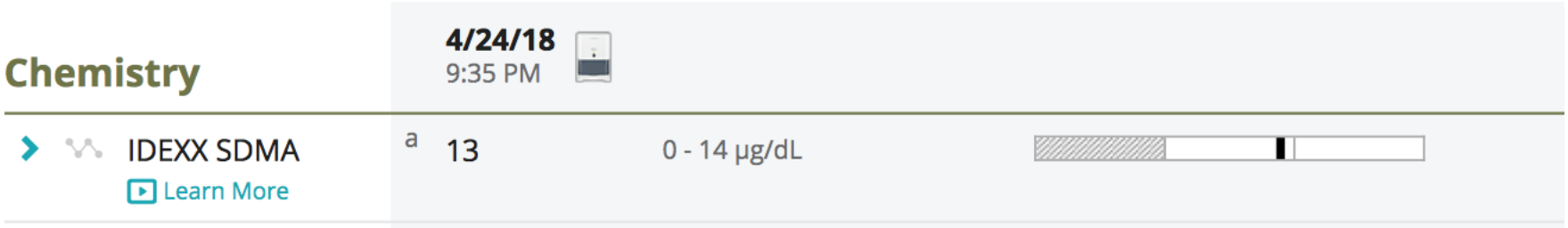

- 沒有空腹？？
- 脫水？？

- 暫停隔日手術
- 暫定一週後再追蹤

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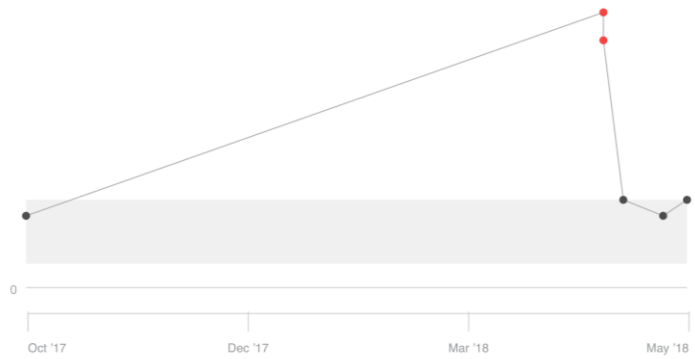
Chemistry	5/22/18 8:16 AM	5/14/18 7:38 PM	5/1/18 7:19 PM	4/24/18 10:42 PM	4/24/18 7:42 PM
Glucose	105	107			**67**
Creatinine	1.8	1.5	1.8	**5.0**	**5.6**
BUN	**30**	25	**31**		**64**
BUN: Creatinine Ratio	17	16	17		11

Cre



BUN

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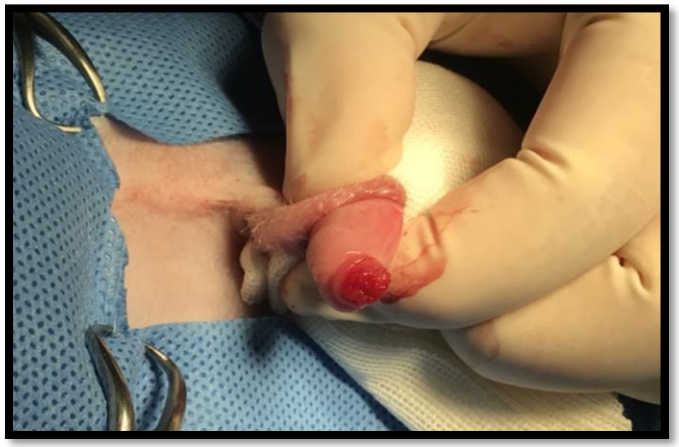
小饅頭

- 1y/o poodle male intact

- 陰莖流血 尿道脫垂
- 術前評估 未空腹



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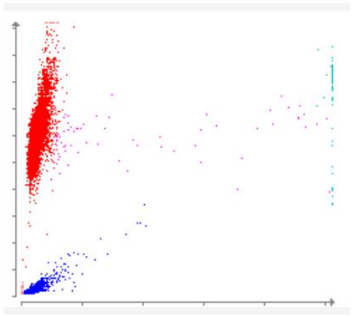
Hematology

5/18/18 9:31 AM

TEST	RESULT	REFERENCE VALUE
RBC	8.11	5.65 - 8.87 M/µL
Hematocrit	53.1	37.3 - 61.7 %
Hemoglobin	18.4	13.1 - 20.5 g/dL
MCV	65.5	61.6 - 73.5 fL
MCH	22.7	21.2 - 25.9 pg
MCHC	34.7	32.0 - 37.9 g/dL
RDW	17.8	13.6 - 21.7 %
% Reticulocyte	0.3	%
Reticulocyte	20.3	10 - 110 K/µL
Reticulocyte Hemoglobin	24.5	22.3 - 29.6 pg
WBC	15.84	5.05 - 16.76 K/µL
% Neutrophil	64.8	%
% Lymphocyte	21.9	%
% Monocyte	10.7	%
% Eosinophil	2.5	%
% Basophil	0.1	%
Neutrophil	10.28	2.95 - 11.64 K/µL
Lymphocyte	3.47	1.05 - 5.1 K/µL
Monocyte	**1.69**	**0.16 - 1.12 K/µL**
Eosinophil	0.39	0.06 - 1.23 K/µL
Basophil	0.01	0 - 0.1 K/µL
Platelet	300	148 - 484 K/µL
PDW	10.0	9.1 - 19.4 fL
MPV	**8.6**	**8.7 - 13.2 fL**
Plateletcrit	0.26	0.14 - 0.46 %



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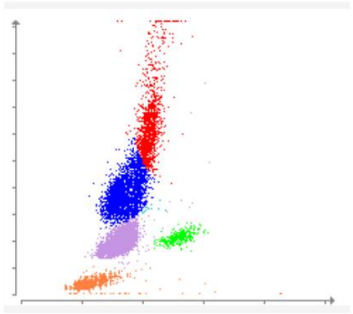

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Chemistry	5/18/18 9:38 AM		
Glucose	94	74 - 143 mg/dL	
IDEXX SDMA Learn More			
Creatinine	**2.4**	0.5 - 1.8 mg/dL	
BUN	19	7 - 27 mg/dL	
BUN: Creatinine Ratio	8		
Sodium	147	144 - 160 mmol/L	
Potassium	4.2	3.5 - 5.8 mmol/L	
Na: K Ratio	35		
Chloride	116	109 - 122 mmol/L	
Total Protein	6.5	5.2 - 8.2 g/dL	
Albumin	3.1	2.3 - 4.0 g/dL	
Globulin	3.3	2.5 - 4.5 g/dL	
Albumin: Globulin Ratio	0.9		
ALT	60	10 - 125 U/L	
ALP	70	23 - 212 U/L	

IDEXX SDMA Learn More	[a] 10	0 - 14 µg/dL	

- 週末，隔三天空腹8小時追蹤

Chemistry	5/21/18 11:33 AM			5/18/18 9:38 AM
Creatinine	0.8	0.5 - 1.8 mg/dL		**2.4**
BUN	21	7 - 27 mg/dL		19
BUN: Creatinine Ratio	26			8

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多比 饅頭 小總結

- Cre 上升，SDMA 正常

- 品種差異性
- 肌肉含量
- 沒有空腹，可能增加Cre 50%，三倍？？

- SDMA<14mg/dL 提高安心感～～
- 持續追蹤

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回顧多比的故事...

關鍵問題:

CREA ↑↑ = 腎臟有問題 ??

嗎??

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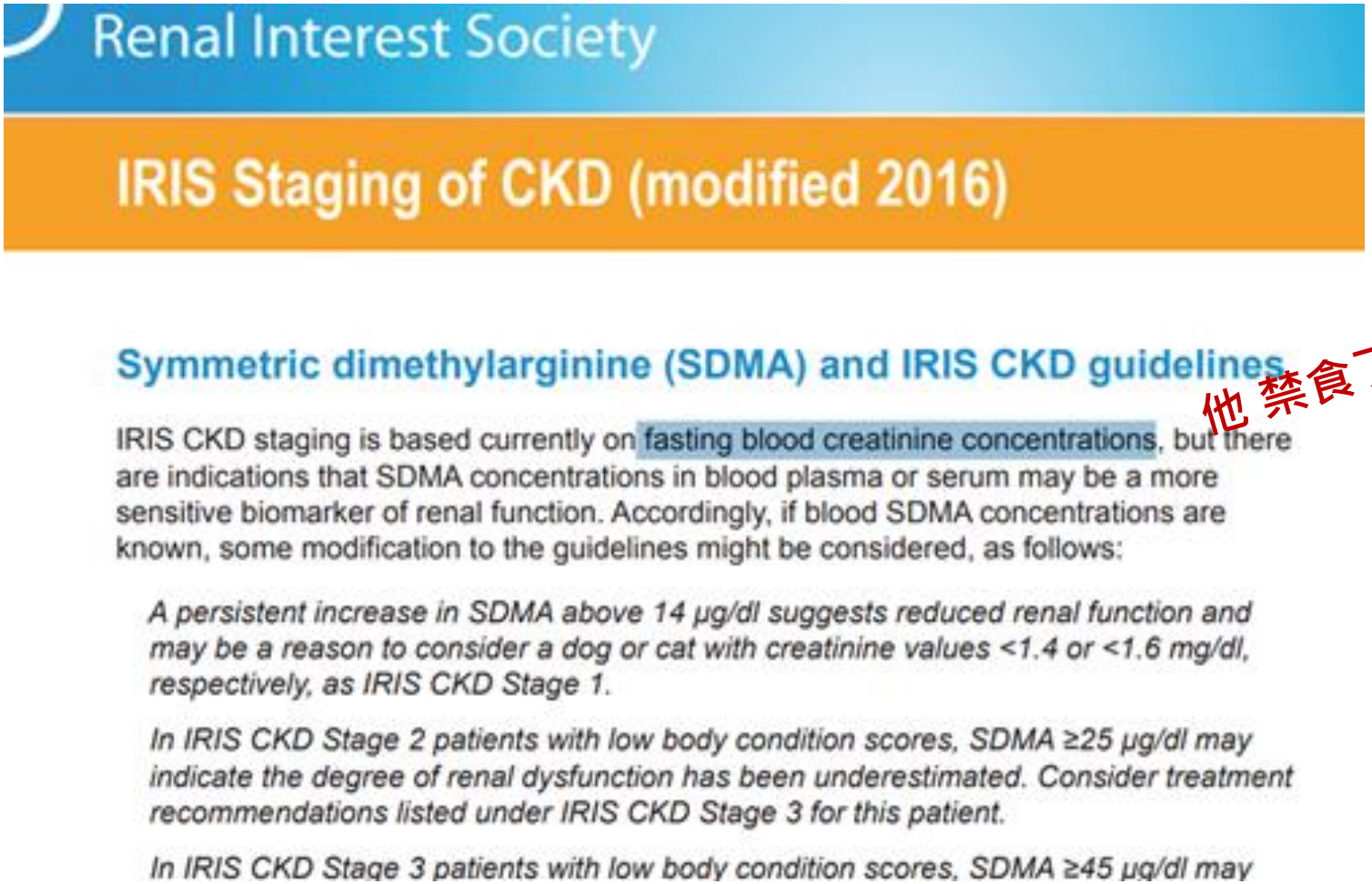
影響血中CREA的因子

http://www.iris-kidney.com/pdf/3_staging-of-ckd.pdf



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影響血中CREA的因子

http://www.iris-kidney.com/education/creatinine_dogs.html

What does an increase in blood creatinine concentration indicate?

The concentration of creatinine in blood (ie, in either plasma or serum) is principally interpreted in relation to renal elimination. When renal function decreases beyond a certain point, an increase in blood creatinine concentration (hypercreatininemia) ensues, usually accompanied by increased urea concentration. "Azotemia" refers to an increases in either or both of these analytes, but the focus here is on creatinine, because of its central role in the IRIS protocols for Staging CKD and for Grading AKI.

Although hypercreatininemia occurs with substantial renal dysfunction, some other possibilities have to be considered as well, because moderate hypercreatininemia could also be related to:

- High muscle production of creatinine, especially in dog breeds with large muscle mass, such as boxers, greyhounds, sled dogs, etc.
- Reduction in extracellular fluid volume: dehydration may increase blood creatinine concentration when dehydration exceeds 5%.
- Intestinal absorption of exogenous creatinine (some creatine in meat is converted to creatinine during cooking).

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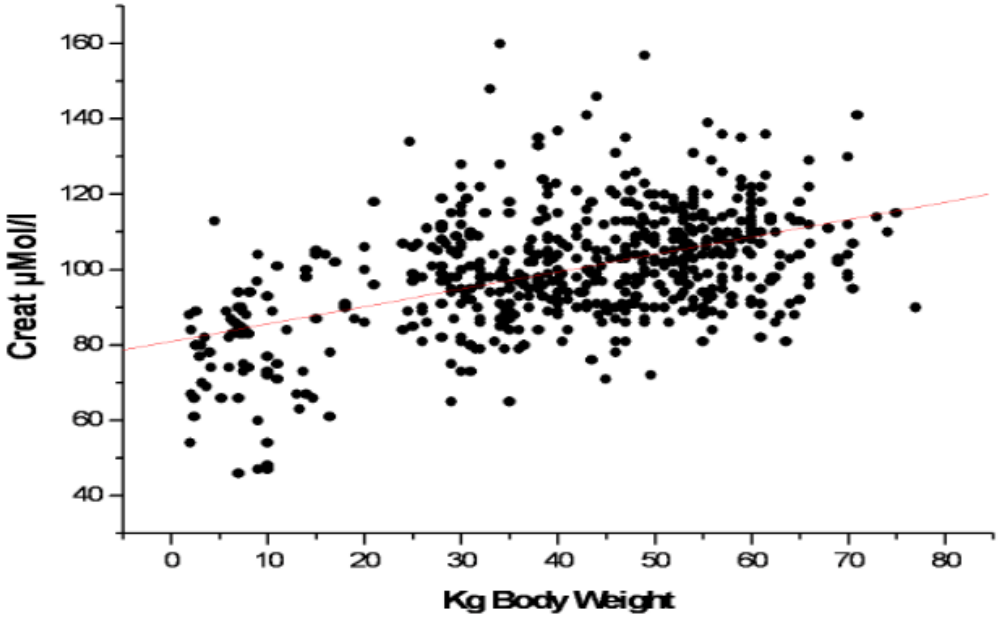
影響血中CREA的因子

- 體型 (體重): 肌肉含量
- 品種

http://www.iris-kidney.com/education/creatinine_dogs.html

Figure 1. Creatinine concentration vs. body size in 567 dogs of various sizes

(graph reproduced with kind permission of J Aasen, R Heiene, C Trangerud and E Teske)



影響血中CREA的因子

他 禁食了嗎??

- 飲食內容

- 飯後1-4 hrs: CREA 可上升50%
- 驗Crea 應最少禁食8 hrs

http://www.iris-kidney.com/education/creatinine_dogs.html

- **Feeding**: Food intake is a potential cause of variation in blood creatinine concentrations. Increased concentrations (up to 50%) may be observed one to four hours after a meal, especially when cooked meat is given. This increase is explained by intestinal absorption of exogenous creatinine generated from muscle creatine during cooking. It is probably preferable, therefore, to sample the dog in the fasted state (at least eight hours fasting).

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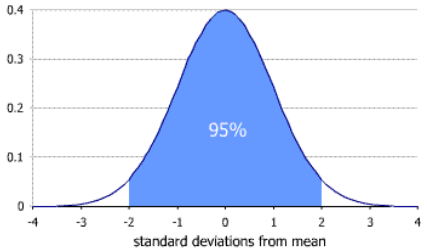
Creatinine 到底要多高才是異常??



http://www.iris-kidney.com/education/creatinine_dogs.html

Two different approaches to interpreting blood creatinine concentrations:

- *A single isolated value from a given dog can be compared to a reference interval.*

1. 跟 別人比 (參考值)

This approach is often the only one available, but it is not ideal. Reference intervals have generally been poorly defined on a limited number of animals and can differ greatly between countries and assays. Thus, a decision threshold can neither be transferred from one laboratory to another, nor from published values to your own practice, unless the conditions are identical.

Remember that hypercreatininemia identified from a single sample does not necessarily mean renal dysfunction is present, but it does indicate a need for other testing (urine specific gravity, proteinuria, etc) to further assess renal function and disease.

一次性的crea不能決定腎功能不全，
需要有更多證據支持。
例如: 尿檢

- *A value obtained at a particular time in a given dog can be compared to another value obtained in the same dog at a previous time.*

2. 跟 自己比 (趨勢)

If conditions are standardized (same technique, fasted dog, etc), this is probably a better way to monitor renal function over time. An increase or a decrease in creatinine generally indicates a decrease or an increase in renal function, respectively, though any possible effects of reduced muscle mass in cachexia should also be considered (see above).

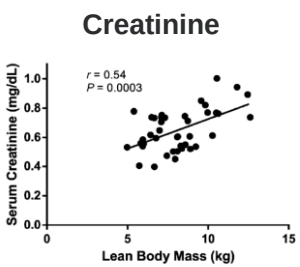
追蹤趨勢，是比較好的方法。

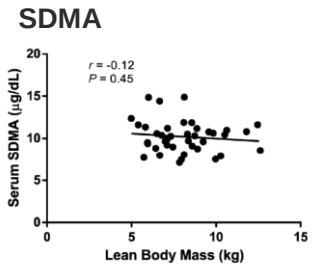
This approach is particularly recommended in animals with identified acute kidney injury or chronic kidney disease, or to detect early nephrotoxic effects of drugs (though other markers such as enzymuria may be considered more sensitive).

This approach is also recommended when assessing fasting blood creatinine concentrations determined as part of a routine health-monitoring program in older patients.

IDEXX

SDMA 在犬貓不會受到肌肉量的影響，正確反映出GFR





"SDMA is a more sensitive indicator of change in renal function in older cats."

Source:
Hall JA, Yerramilli M, Obare M, Yerramilli M, Melendez LD, Jewel DE. Relationship between lean body mass and serum renal biomarkers in healthy dogs. *J Vet Intern Med*. 2015;29(3):808–814.
Hall JA, Yerramilli M, Obare E, Yerramilli M, Yu S, Jewell DE. Comparison of serum concentrations of symmetric dimethylarginine and creatinine as kidney function biomarkers in healthy geriatric cats fed reduced protein foods enriched with fish oil, L-carnitine, and medium-chain triglycerides. Vet J. 2014;202(3):588–596.

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Case 2 多比 回顧

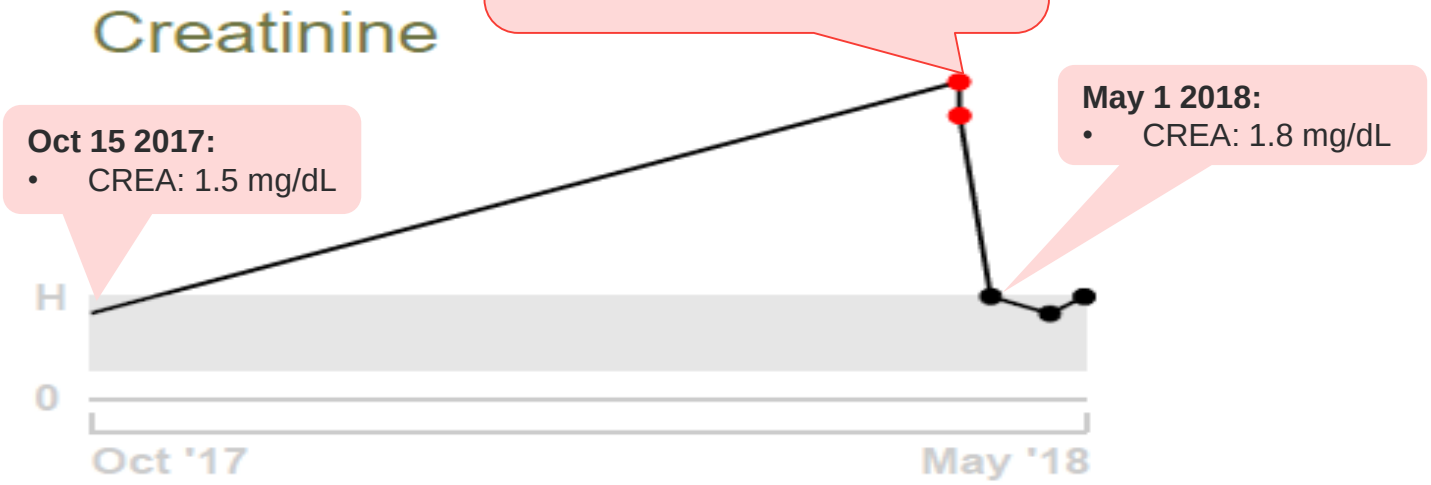
如何區別是不是腎臟真的有問題???

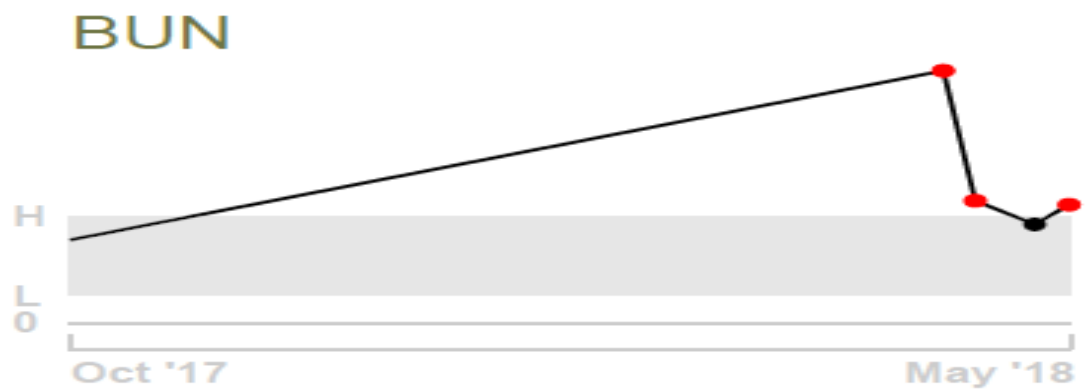
尋找更多證據...

Apr 24 2018:
- CREA: 5.6 mg/dL
- SDMA: 13 ug/dL

Oct 15 2017:
- CREA: 1.5 mg/dL

May 1 2018:
- CREA: 1.8 mg/dL





Case 2 多比 回顧

有沒有其他支持腎功能異常的證據??

Chemistry

TEST	RESULT	5/22/18 8:16 AM	4/24/18 7:42 PM	
		HCT= 36.9%	HCT= 49.9%	
Glucose	105	67	70 - 143 mg/dL	
Creatinine	1.8	5.6	0.5 - 1.8 mg/dL	
BUN	30	64	7 - 27 mg/dL	
BUN: Creatinine Ratio	17	11		
Sodium	153	148	144 - 160 mmol/L	
Potassium	5.3	4.1	3.5 - 5.8 mmol/L	
Na: K Ratio	29	36		
Chloride	116	112	109 - 122 mmol/L	
Total Protein	6.5	7.2	5.2 - 8.2 g/dL	
Albumin	2.6	3.0	2.2 - 3.9 g/dL	
Globulin	4.0	4.3	2.5 - 4.5 g/dL	
Albumin: Globulin Ratio	0.7	0.7		
ALT	41	79	10 - 125 U/L	
ALP	117	73	23 - 212 U/L	
Osmolality	312	310	mmol/kg	

GFR

SDMA=13

腎小管

水合狀態

水合狀態

水合狀態

IDEXX

Case 2 多比 回顧

臨床意義	指數	1. 腎灌流不足 (ex. 脫水)	2. 功能腎元不足 (ex. 腎臟疾病)
GFR 狀態	BUN, Crea, SDMA	↑ (GFR減少)	↑ (GFR減少)
腎小管 尿濃縮能力	尿比重 (USG)	↑	↓
水合狀態	TP, ALB, Hct Na, Cl	↑	不一定

Urinalysis — 4/24/18 9:00 PM

Collection	Cystocentesis	
Color	Straw	
Clarity	Clear	
Specific Gravity	1.015	
pH	5.0	
Urine Protein	neg	
Glucose	neg	
Ketones	neg	
Blood / Hemoglobin	50	Ery/µL
Bilirubin	neg	
Urobilinogen	norm	
Leukocyte Esterase	100	Leu/µL
	Confirm all leukocyte results with microscopy	

所以腎臟真的有問題嗎??

尿比重可以採信嗎??

Case 2 多比 回顧

所以遇到 CREA 高， SDMA 低，我的建議是:

1. 確認是否有禁食。

2. 確認 CREA 的常態值。

3. 確認 尿檢 & 其他相關證據。

4. 追蹤 (不應該一下子跳到腎臟有問題的結論....)

5. 打電話到 IDEXX 技術服務專線:
0800-291018 #1

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Q&A

完整的尿液學檢查

1. 尿的物理特性: 尿液外觀(性狀)評估

顏色:	淡黃	深黃	黃綠	橘紅	紅色	深褐
混濁度:	澄清透明	輕為霧狀	雲霧狀	混濁		

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1. 尿的物理特性：尿比重(USG)的测量

2. 尿液的化學成分: 尿液試條紙

TEST MENU

Parameters

pH

LEU (leukocytes)

PRO (protein)

GLU (glucose)

KET (ketones)

UBG (urobilinogen)

BIL (biliruben)

BLD/HGB (blood/hemoglobin)

Note: The IDEXX VetLab UA Analyzer does not read or print NIT (nitrate) and SG (specific gravity) results. Experts agree, specific gravity should be measured with a refractometer.

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尿液試條紙 檢測結果判讀

Parameter	Conventional Units (Conv.)	SI Units (SI)	Arbitrary Units (Arbitrary)
SG (specific gravity)	Measure with refractometer		
pH	5 6 6.5 7 8 9	5 6 6.5 7 8 9	5 6 6.5 7 8 9
LEU (leukocytes) *Confirm all canine leukocytes results with microscopy*	neg 25 Leu/µL 100 Leu/µL 500 Leu/µL	neg 25 Leu/µL 100 Leu/µL 500 Leu/µL	neg 1+ 2+ 3+
PRO (protein)	neg TR 30 mg/dL 100 mg/dL 500 mg/dL	neg TR 0.3 g/L 1.0 g/L 5.0 g/L	neg TR 1+ 2+ 3+
GLU (glucose)	neg 50 mg/dL 100 mg/dL 300 mg/dL 1000 mg/dL	neg 3 mmol/L 6 mmol/L 17 mmol/L 56 mmol/L	neg 1+ 2+ 3+ 4+
KET (ketone)	neg 15 mg/dL 50 mg/dL 150 mg/dL	neg 1.5 mmol/L 5 mmol/L 15 mmol/L	neg 1+ 2+ 3+
UBG (urobilinogen)	norm 1 mg/dL 4 mg/dL 8 mg/dL 12 mg/dL	norm 7 µmol/L 70 µmol/L 140 µmol/L 200 µmol/L	norm 1+ 2+ 3+ 4+
BIL (bilirubin)	neg 1 mg/dL 3 mg/dL 6 mg/dL	neg 17 µmol/L 50 µmol/L 100 µmol/L	norm 1+ 2+ 3+
BLD (blood/hemoglobin)	neg 10 Ery/µL 25 Ery/µL 50 Ery/µL 250 Ery/µL	neg 10 Ery/µL 25 Ery/µL 50 Ery/µL 250 Ery/µL	neg 1+ 2+ 3+ 4+

Note: NIT (nitrate) and SG (specific gravity) results are not read or printed by the IDEXX VetLab UA Analyzer.

需搭配尿比重，進行判讀評估。
如果PRO 2+ 需進行UPC。*先確認尿渣!!!*


IDEXX VetLab UA
Dev. ID: 8093
Seq. No: 1
Pat. ID
07-12-2010 02:21 p.m.

Coll. Meth. free catch
Vol. 6 mls
Color. yellow
Clarity. cloudy
SG. 1.016
Sed. 3-5 epi cells
3+ Amn mg phos
amorphous debris

pH	5	
*LEU	neg	
PRO	30	mg/dl
GLU	neg	
KET	neg	
UBG	norm	
BIL	neg	
BLD	neg	

*Confirm with Microscopy

以人工方式，將以下資訊輸入到由愛德士檢驗資料管理系統，產生的病患報告單，列印輸出（圖1）或綜合診斷報告：

- 收集方法（收集方法）
- 容積 (Vol.)
- 顏色
- 清晰度
- 比重（SG）
- 沉澱分析（Sed.）

2. 尿液的化學成分: 尿液試條紙

IDEXX UA™ Strips

Specific Gravity: ***The urine specific gravity should be measured with a refractometer***, which measures the density of the urine relative to the density of water. This value should be interpreted in light of the patient's hydration status and serum blood urea nitrogen (BUN) and creatinine levels.

X USG

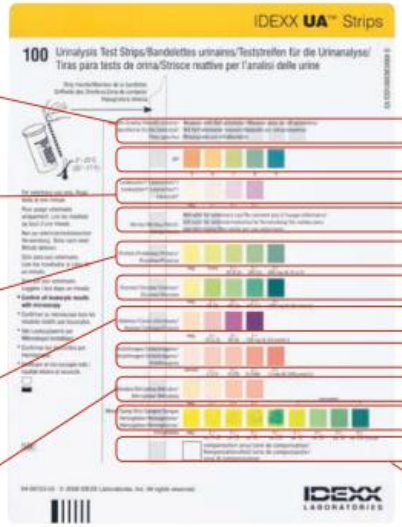
Leukocytes: The leukocyte test pad detects the enzyme leukocyte esterase, not individual leukocytes. ***Evaluation of urine leukocytes must be confirmed by urine microscopic examination.*** The sensitivity and specificity of the leukocyte esterase test pad is questionable in veterinary medicine, especially in cat urine.

X WBC

Protein: While small amounts of protein may normally be found in the urine, proteinuria can indicate both renal and nonrenal disease. If significant proteinuria is detected and there is an inactive sediment, urine protein:creatinine ratio (UPC) should be performed for protein quantification for accurate assessment and monitoring.

Ketones: Urine ketones are produced by the breakdown of lipids. Causes for elevations include diabetic ketoacidosis, prolonged fasting, starvation and low-carbohydrate diets.

Bilirubin: In dogs (especially male dogs) bilirubinuria is common even under normal conditions, but any bilirubinuria in cats is significant. Bilirubinuria usually precedes bilirubinemia because urine is commonly concentrated (hypersthenuric) compared to plasma.



pH: Urine pH is determined by the kidney's ability to regulate hydrogen ion and bicarbonate concentrations within the blood. Urine pH may reflect the animal's acid-base status if hydration status and overall plasma electrolyte balance are not markedly disturbed.

Nitrite X

Nitrite: The nitrite test is not valid for veterinary use. The majority of bacterial infections in dogs and cats are not caused by organisms that reduce nitrate to nitrite. Both false positive and false negative results are common in veterinary medicine, making this assay too insensitive for general use.

Glucose: Glucose is not usually detectable in the urine of dogs and cats and must exceed the renal threshold for reabsorption to be noted. This value should be evaluated in light of the patient's activity status and blood glucose level.

Urobilinogen: Intestinal bacteria convert conjugated bilirubin to urobilinogen. A freshly produced urine sample is necessary for evaluation. The correlation between increases or decreases of urine urobilinogen and liver disease in animals is poor.

Blood: The blood/heme reaction detects heme groups found within hemoglobin and myoglobin. The test may be positive because of hematuria, hemoglobinuria or myoglobinuria.

Compensation Pad: This white pad, which is not impregnated with reagents, is used by the IDEXX VetLab UA Analyzer to compensate for the intensive intrinsic color of the urine that might affect the evaluation of the parameters for leukocytes, protein, glucose, ketone bodies, urobilinogen and bilirubin.

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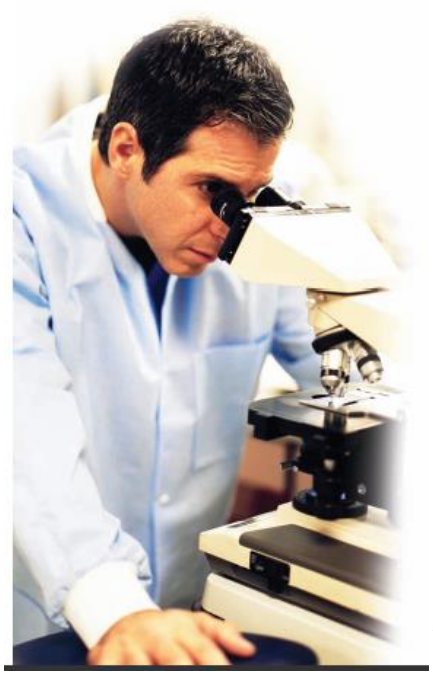
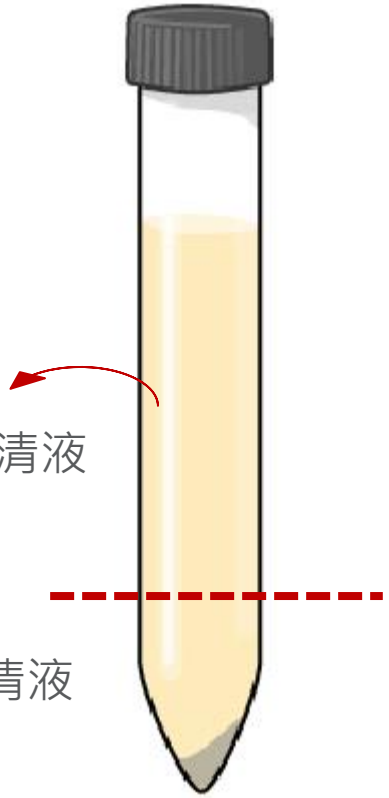
3. 尿液的細胞學: 尿液殘渣檢查

1. 將尿液倒入離心管。
2. 離心 5 min (1,500 rpm)。
3. 五倍濃縮尿渣。(移除4/5上清液)
4. 混合剩餘尿液檢體。
5. 取20 uL滴於載波片。
6. 蓋上蓋波片，於顯微鏡下觀察。





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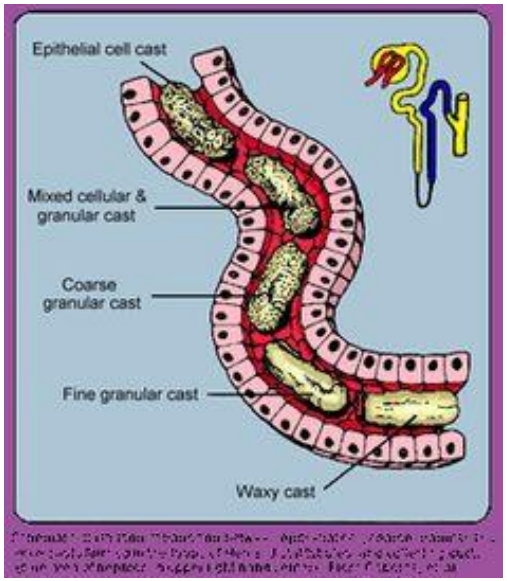
3. 尿液的細胞學: 尿液殘渣檢查

腎小管損傷 : 尿圓柱(cast)
(LPF; 10X)



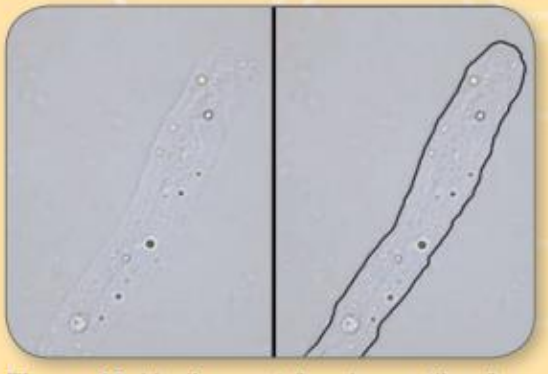


Figure 13 Hyaline cast (borders outlined)

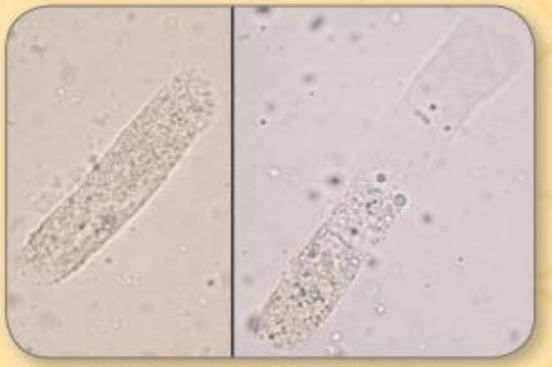


Figure 14 Granular (left) and mixed waxy and granular (right) casts

Figure 15 Waxy cast

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3. 尿液的細胞學: 尿液殘渣檢查

泌尿道炎症及/或感染: WBC , 細菌
(HPF: 40X)

Figure 1 Erythrocytes and one squamous epithelial cell

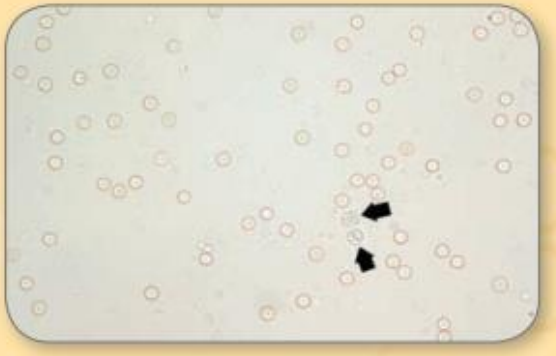

Figure 2 Erythrocytes and two leukocytes (black arrows)

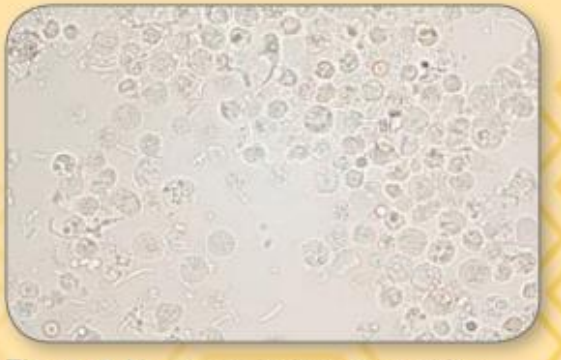

Figure 3 Numerous leukocytes and few rod-shaped bacteria

Figure 4 Many rod-shaped bacteria 100x objective field of view

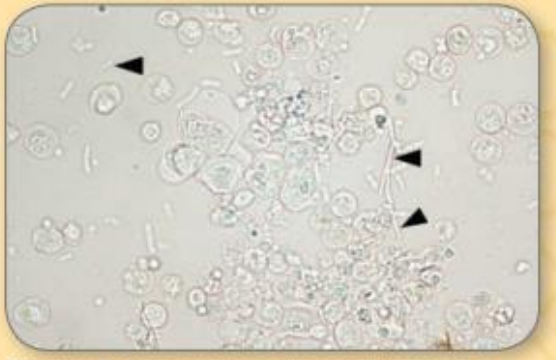

Figure 5 Many leukocytes and large rod-shaped bacteria (black arrowheads)

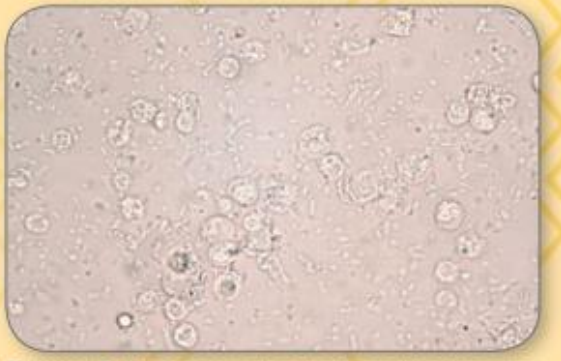

Figure 6 Numerous bacteria and leukocytes

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3. 尿液的細胞學: 尿液殘渣檢查

結晶：結石或異常代謝產物

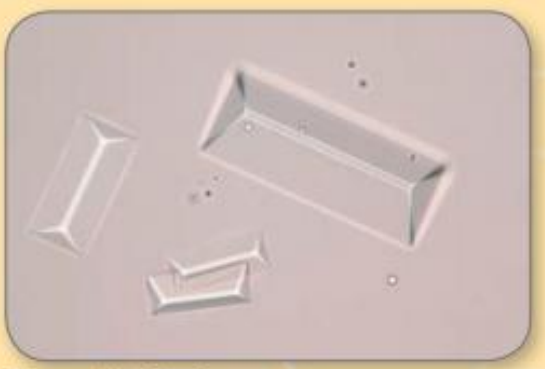

Figure 16 Struvite

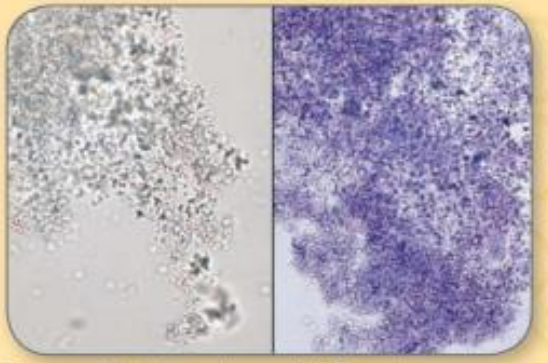

Figure 17 Amorphous (NMB wet prep on right)

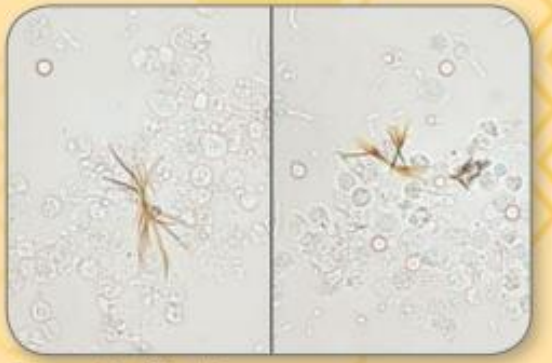

Figure 18 Bilirubin

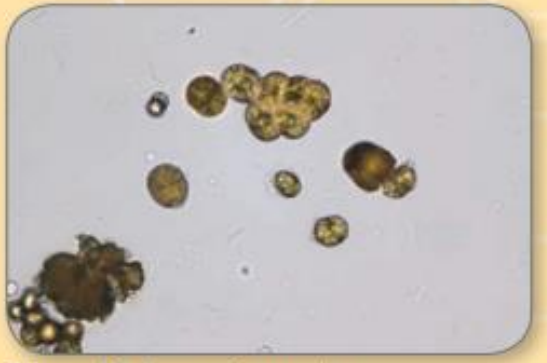

Figure 19 Ammonium urate

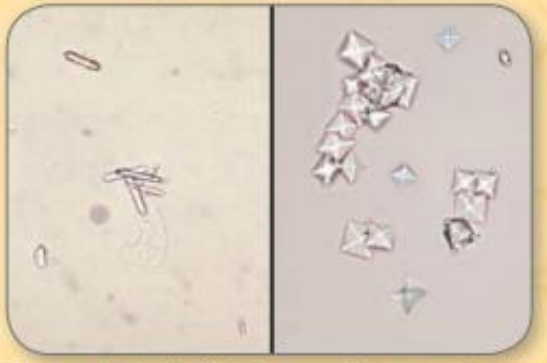

Figure 20 Left: Calcium oxalate monohydrate
Right: Calcium oxalate dihydrate

Figure 21 Drug (Tribrissen™) crystals 10x objective field of view

3. 尿液的細胞學: 尿液殘渣檢查

膀胱癌：移行上皮細胞腫瘤

****看到重要的異常，需染色確認!!**

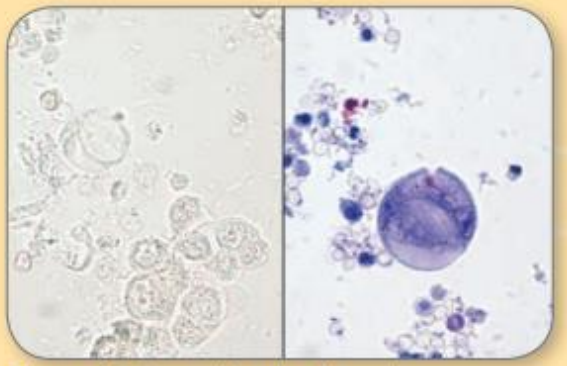

Figure 10 Transitional cell carcinoma (NMB wet prep on right)

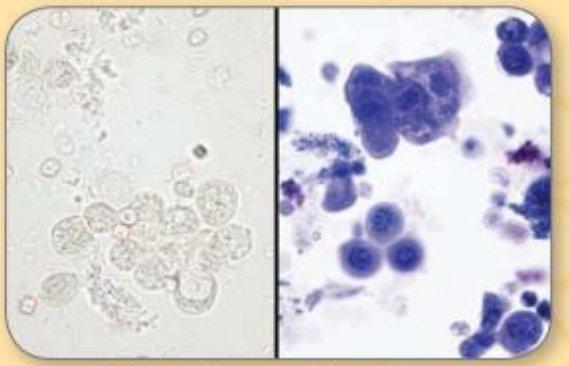

Figure 11 Transitional cell carcinoma (NMB wet prep on right)

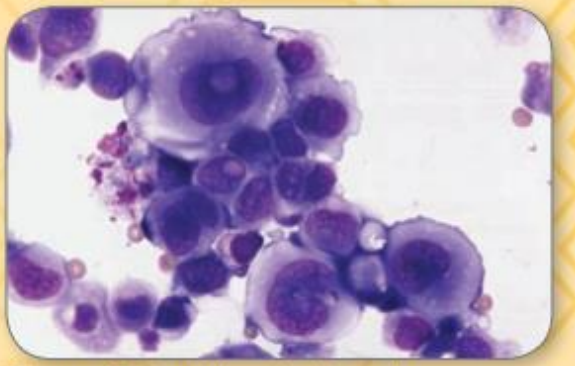

Figure 12 Transitional cell carcinoma—air-dried and Diff-Quik® stained

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3. 尿液的細胞學: 尿液殘渣檢查

Interpretation (Expected Values)		
Analyte	**Normal**	**Reporting Results**
WBC	0–5 / HPF	Number / HPF
RBC	0–5 / HPF	Number / HPF
Epithelial Cells	0–Few / HPF	Number / HPF
Crystals	Variable	Number / LPF
Casts	0–Few / LPF	Number / LPF
Bacteria	0–Few / HPF	1 + to 4 + / HPF

IDEXX VetLab® UA™ Analyzer and IDEXX UA™ Strips

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Break

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Case 3 Gaykey

- 10y/o 西施 Male

- 食慾下降嘔吐約1-2週
- 理學檢查
- Depressed,
- 8% hydration,
- pale MM

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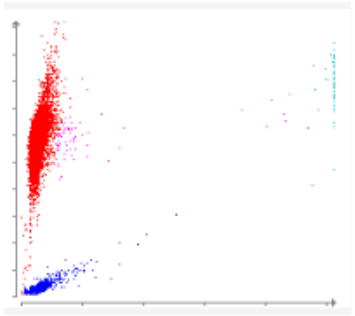
Hematology

2/7/18 2:11 PM

TEST	RESULT	REFERENCE VALUE
RBC	**5.55**	**5.65 - 8.87 M/µL**
Hematocrit	40.7	37.3 - 61.7 %
Hemoglobin	**12.6**	**13.1 - 20.5 g/dL**
MCV	73.3	61.6 - 73.5 fL
MCH	22.7	21.2 - 25.9 pg
MCHC	**31.0**	**32.0 - 37.9 g/dL**
RDW	15.4	13.6 - 21.7 %
% Reticulocyte	0.3	%
Reticulocyte	14.4	10 - 110 K/µL
WBC	12.69	5.05 - 16.76 K/µL
% Neutrophil	84.4	%
% Lymphocyte	9.1	%
% Monocyte	4.8	%
% Eosinophil	1.5	%
% Basophil	0.2	%
Neutrophil	10.71	2.95 - 11.64 K/µL
Lymphocyte	1.16	1.05 - 5.1 K/µL
Monocyte	0.61	0.16 - 1.12 K/µL
Eosinophil	0.19	0.06 - 1.23 K/µL
Basophil	0.02	0 - 0.1 K/µL
Platelet	466	148 - 484 K/µL
PDW	11.2	9.1 - 19.4 fL
MPV	9.1	8.7 - 13.2 fL
Plateletcrit	0.42	0.14 - 0.46 %



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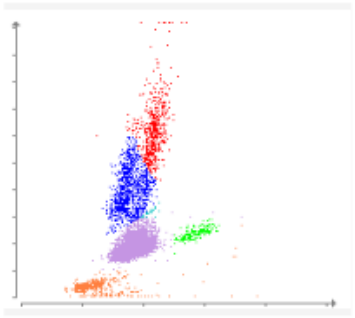

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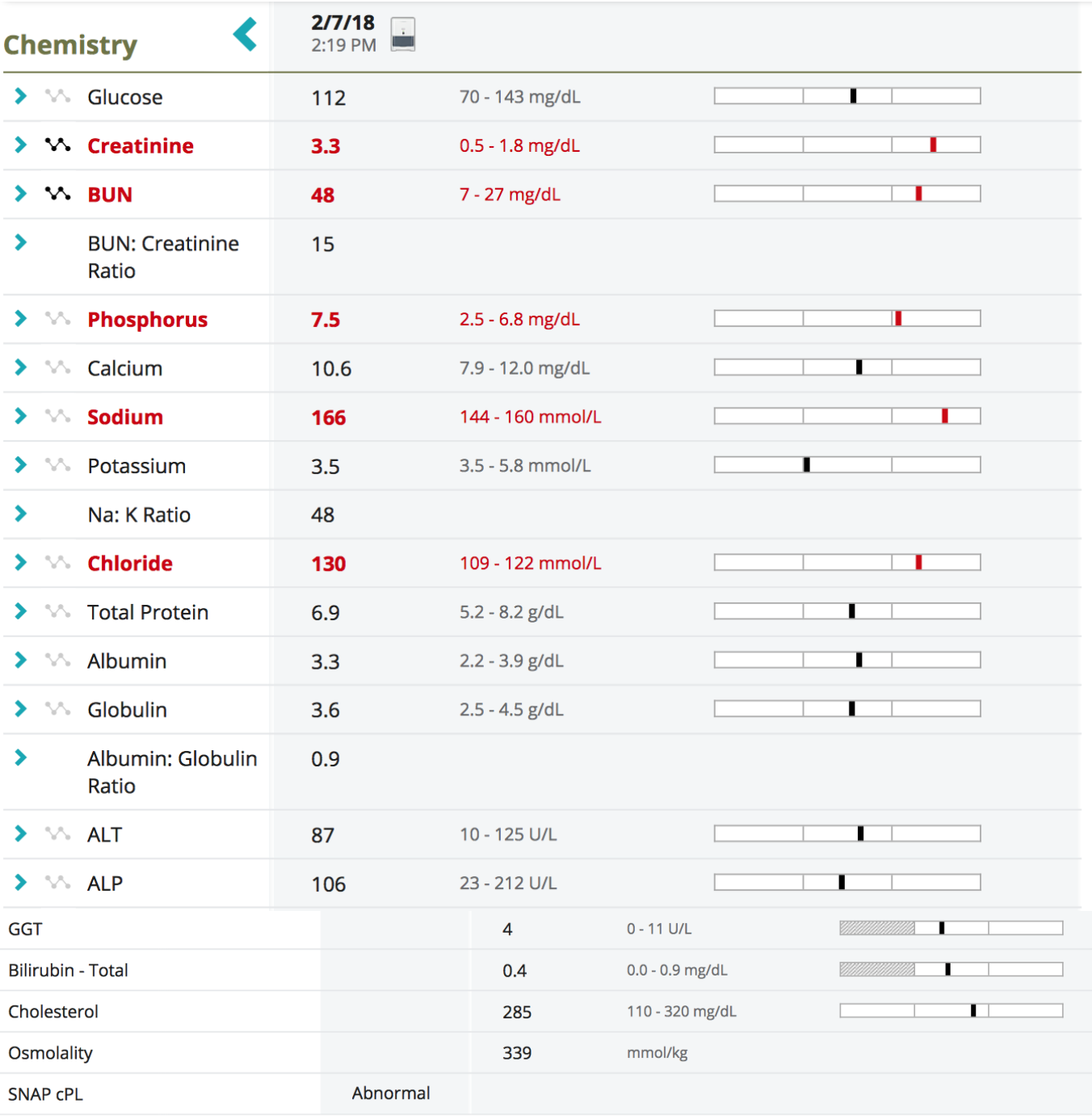

Chemistry	2/7/18 2:19 PM		
Glucose	112	70 - 143 mg/dL	
Creatinine	**3.3**	0.5 - 1.8 mg/dL	
BUN	**48**	7 - 27 mg/dL	
BUN: Creatinine Ratio	15		
Phosphorus	**7.5**	2.5 - 6.8 mg/dL	
Calcium	10.6	7.9 - 12.0 mg/dL	
Sodium	**166**	144 - 160 mmol/L	
Potassium	3.5	3.5 - 5.8 mmol/L	
Na: K Ratio	48		
Chloride	**130**	109 - 122 mmol/L	
Total Protein	6.9	5.2 - 8.2 g/dL	
Albumin	3.3	2.2 - 3.9 g/dL	
Globulin	3.6	2.5 - 4.5 g/dL	
Albumin: Globulin Ratio	0.9		
ALT	87	10 - 125 U/L	
ALP	106	23 - 212 U/L	
GGT	4	0 - 11 U/L	
Bilirubin - Total	0.4	0.0 - 0.9 mg/dL	
Cholesterol	285	110 - 320 mg/dL	
Osmolality	339	mmol/kg	
SNAP cPL	Abnormal		

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Urinalysis

		2/8/18 10:01 AM	
	Collection	Cystocentesis	
›	Color	Straw	
›	Clarity	Clear	
›	Specific Gravity	1.013	
›	pH	6.0	
›	Urine Protein	30	mg/dL
›	Glucose	100	mg/dL
›	Ketones	neg	
›	Blood / Hemoglobin	250	
›	Bilirubin	neg	
›	Urobilinogen	norm	
	Leukocyte Esterase	neg	

Confirm all leukocyte results with microscopy

建議執行 UPC。考慮尿沉渣結果。

Chemistry

		2/8/18 10:42 AM	
	Urine Creatinine	33	mg/dL
	Urine Protein	62	mg/dL
›	Urine Protein: Creatinine Ratio	1.89	

IDEXX

1. 檢驗項目:

檢驗項目	物種	(編號) 檢驗內容	檢體數
嗜氧培養	犬-Gaykey	(1) 膀胱穿刺採尿	1

2. 細菌分離鑑定結果

樣品	檢體抹片半定量	病原鑑定與半定量結果	培養描述
(1)	(1+) 革蘭氏陰性破碎染色顆粒 未見典型細菌細胞	無生長	嗜氧條件直接接種平板 72 小時無生長 嗜氧條件 1:10~1:50 液態增菌 72 小時無生長

增菌培養液與平板培養基會於 72、96 與 120 小時各別再觀察一次，如有生長即發送補充報告，仍未觀察到細菌生長則不另外通知。

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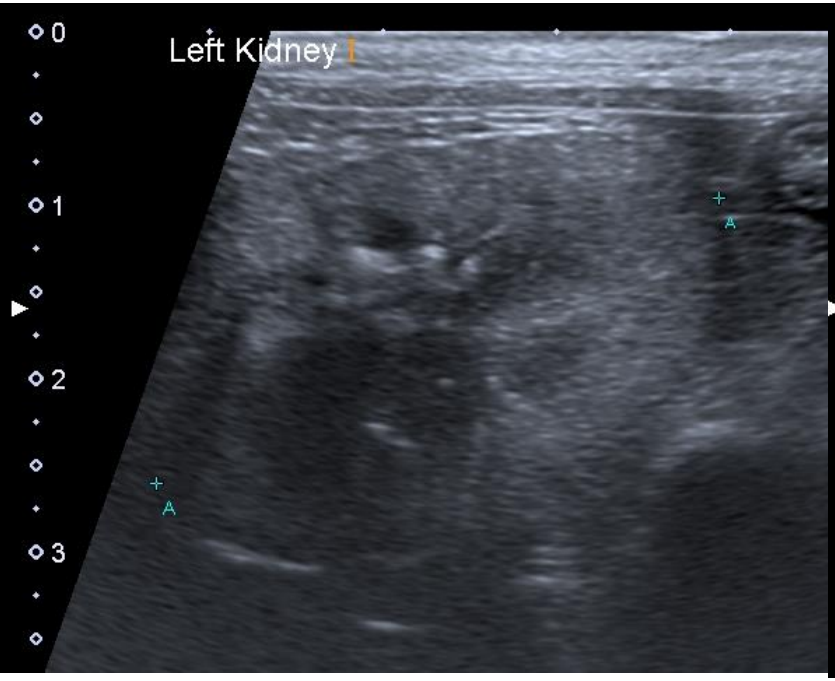

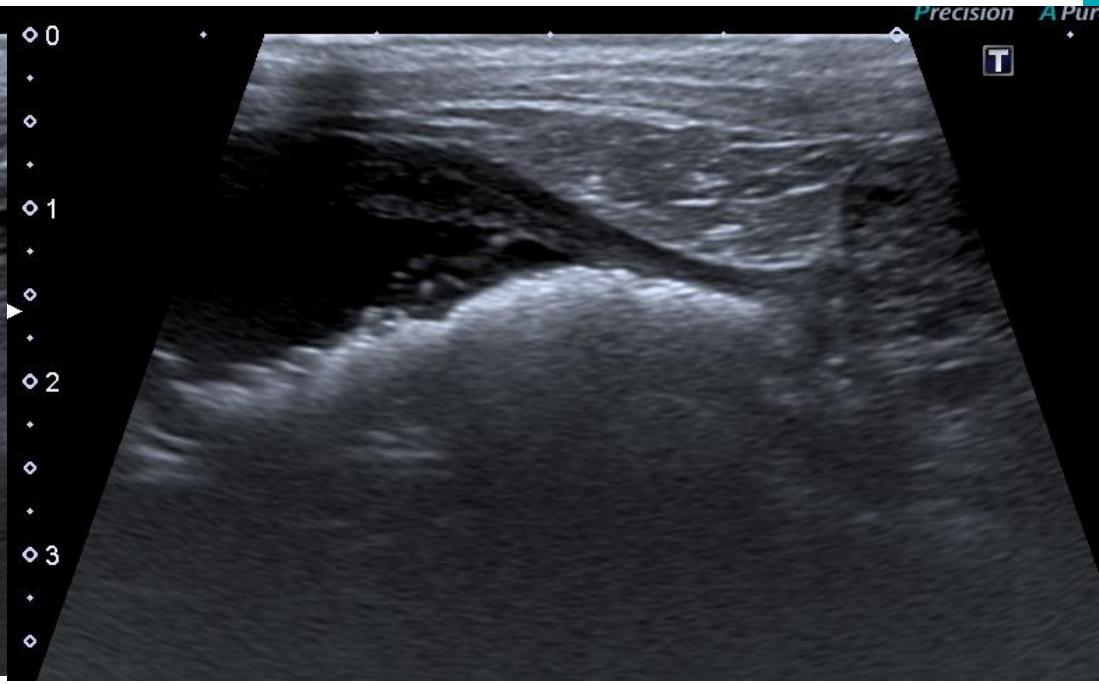

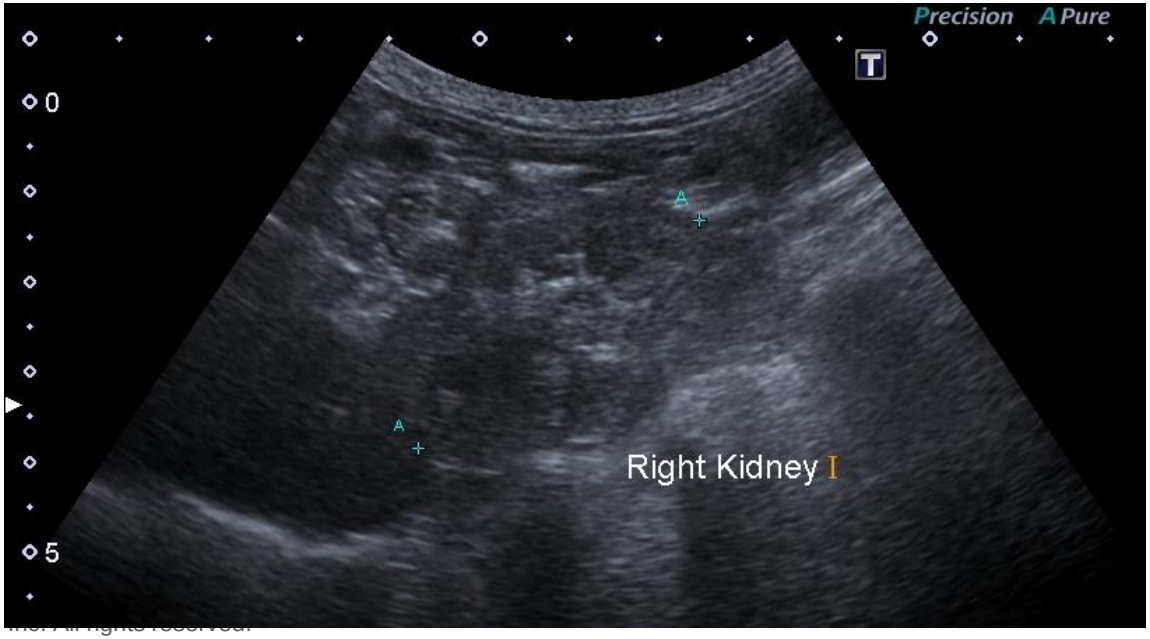

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治療計劃

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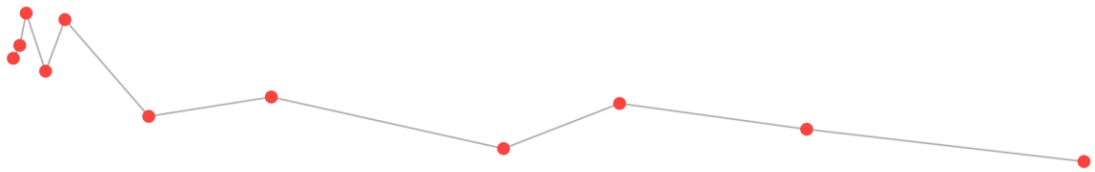
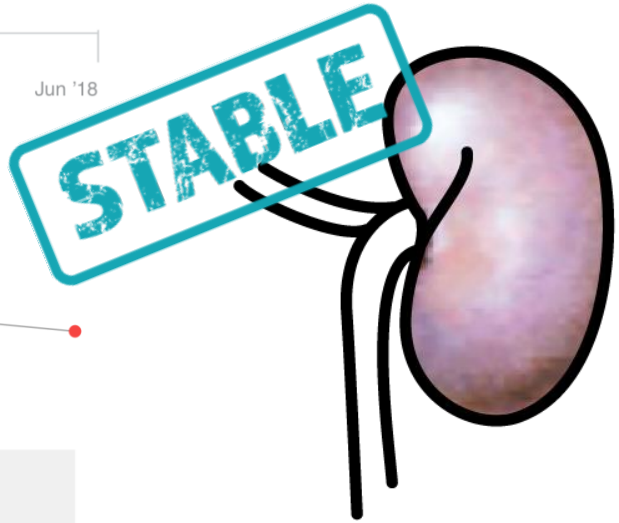
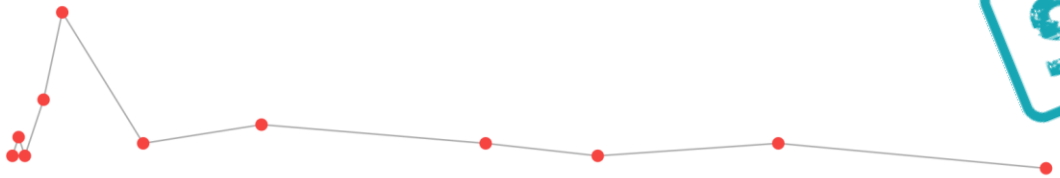


BUN





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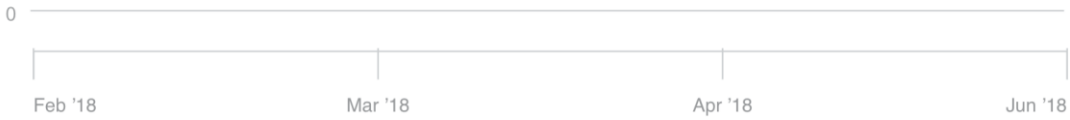
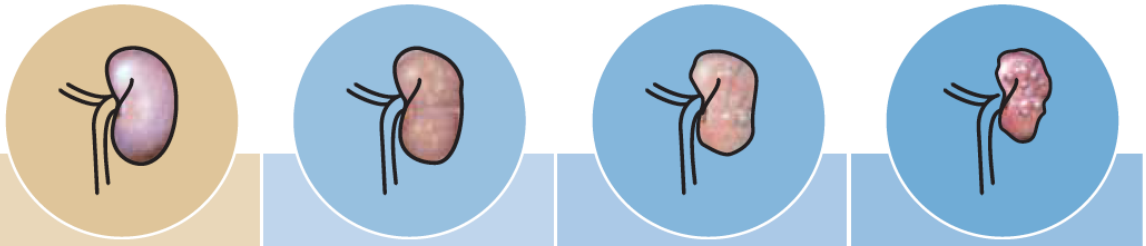


Step 2: Stage CKD



	Stage 1 No azotemia	Stage 2 Mild	Stage 3 Moderate	Stage 4 Severe
Creatinine in mg/dL				
Stage based on stable creatinine — Canine	<1.4	1.4–2.0	2.1–5.0	>5.0
Stage based on stable creatinine — Feline	<1.6	1.6–2.8	2.9–5.0	>5.0
SDMA in µg/dL	>14	>14	Moderately increased	Markedly increased
Consider understaged based on creatinine		≥25		
Consider understaged based on creatinine			≥45	
UPC ratio				
Substage based on proteinuria — Canine	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.5**	Proteinuric **>0.5**	
Substage based on proteinuria — Feline	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.4**	Proteinuric **>0.4**	
Systolic blood pressure in mm Hg Substage based on blood pressure	Normotensive **<150**	Borderline hypertensive **150–159**	Hypertensive **160–179**	Severely hypertensive **≥180**

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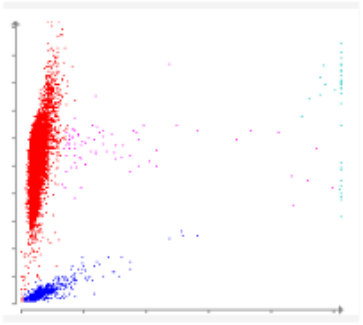
Hematology

6/8/18 1:54 PM

TEST	RESULT	REFERENCE VALUE
RBC	7.24	5.65 - 8.87 M/µL
Hematocrit	41.6	37.3 - 61.7 %
Hemoglobin	14.3	13.1 - 20.5 g/dL
MCV	**57.5**	**61.6 - 73.5 fL**
MCH	**19.8**	**21.2 - 25.9 pg**
MCHC	34.4	32.0 - 37.9 g/dL
RDW	21.7	13.6 - 21.7 %
% Reticulocyte	0.3	%
Reticulocyte	21.7	10 - 110 K/µL
Reticulocyte Hemoglobin	23.7	22.3 - 29.6 pg
WBC	10.43	5.05 - 16.76 K/µL
% Neutrophil	57.1	%
% Lymphocyte	29.5	%
% Monocyte	5.8	%
% Eosinophil	7.5	%
% Basophil	0.1	%
Neutrophil	5.96	2.95 - 11.64 K/µL
Lymphocyte	3.08	1.05 - 5.1 K/µL
Monocyte	0.6	0.16 - 1.12 K/µL
Eosinophil	0.78	0.06 - 1.23 K/µL
Basophil	0.01	0 - 0.1 K/µL
Platelet	**514**	**148 - 484 K/µL**
PDW	10.9	9.1 - 19.4 fL
MPV	**8.4**	**8.7 - 13.2 fL**
Plateletcrit	0.43	0.14 - 0.46 %



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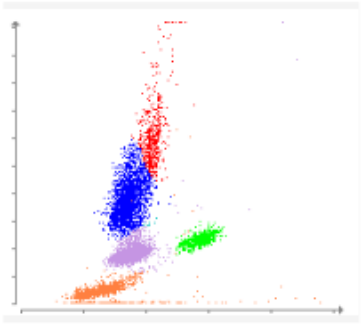

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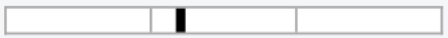
Chemistry

	6/8/18 2:01 PM		
IDEXX SDMA Learn More	[a] **69**	0 - 14 µg/dL	
Creatinine	**3.1**	0.5 - 1.8 mg/dL	
BUN	**35**	7 - 27 mg/dL	
BUN: Creatinine Ratio	11		
Phosphorus	4.1	2.5 - 6.8 mg/dL	
Calcium	**12.5**	7.9 - 12.0 mg/dL	
Sodium	147	144 - 160 mmol/L	
Potassium	5.2	3.5 - 5.8 mmol/L	
Na: K Ratio	28		
Chloride	113	109 - 122 mmol/L	
Albumin	3.2	2.2 - 3.9 g/dL	

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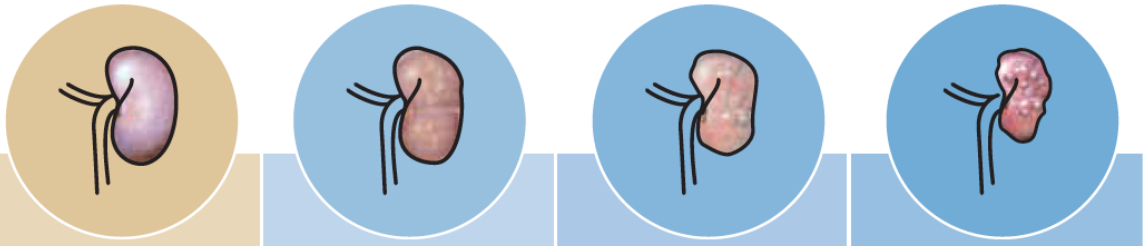
Step 2: Stage CKD



	Stage 1 No azotemia	Stage 2 Mild	Stage 3 Moderate	Stage 4 Severe
Creatinine in mg/dL				
Stage based on stable creatinine — Canine	<1.4	1.4–2.0	2.1–5.0	>5.0
Stage based on stable creatinine — Feline	<1.6	1.6–2.8	2.9–5.0	>5.0
SDMA in µg/dL	>14	>14	Moderately increased	Markedly increased
Consider understaged based on creatinine		≥25		
Consider understaged based on creatinine			≥45	
UPC ratio — Substage based on proteinuria — Canine	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.5**	Proteinuric **>0.5**	
UPC ratio — Substage based on proteinuria — Feline	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.4**	Proteinuric **>0.4**	
Systolic blood pressure in mm Hg Substage based on blood pressure	Normotensive **<150**	Borderline hypertensive **150–159**	Hypertensive **160–179**	Severely hypertensive **≥180**

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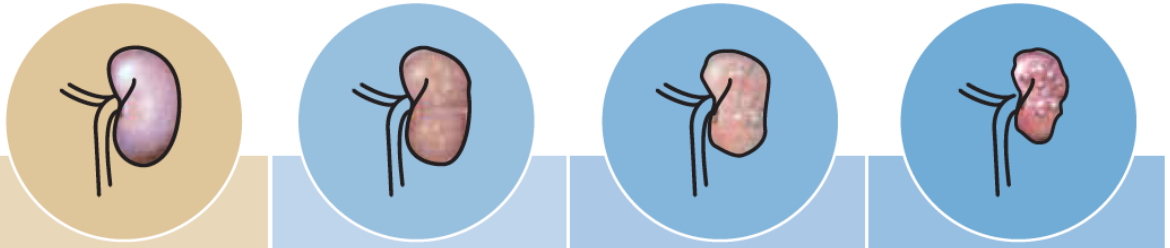
Step 3: Treat CKD



Stage 1
No azotemia

- Investigate for and treat underlying disease
- Treat hypertension if systolic blood pressure persistently >160 or evidence of end-organ damage
- Treat persistent proteinuria with therapeutic diet and medication (UPC >0.5 in dogs; UPC >0.4 in cats)
- Keep phosphorus <4.6 mg/dL
- If required, use kidney therapeutic diet +/– phosphate binder
- Use with caution potentially nephrotoxic drugs
- Correct prerenal and postrenal abnormalities
- Fresh water available at all times

Stage 2
Mild

- Same as Stage 1
- Kidney therapeutic diet
- Treat hypokalemia in cats
- Treat metabolic acidosis
- If SDMA ≥25, consider treatment for Stage 3

Stage 3
Moderate

- Same as Stage 2
- Keep phosphorus <5.0 mg/dL
- Treat anemia (PCV <25% in dogs; PCV <20% in cats)
- Treat vomiting/inappetence/nausea
- Consider subcutaneous and/or enteral fluids to maintain hydration
- Consider calcitriol therapy in dogs
- If SDMA ≥45, consider treatment for Stage 4

Stage 4
Severe

- Same as Stage 3
- Keep phosphorus <6.0 mg/dL
- Consider feeding tube for nutritional and hydration support and for ease of medicating

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Gaykey 小總結

- Cre 上升，SDMA 上升
- 慢性腎病分級，以SDMA，Cre 合併評估，避免低估疾病嚴重程度
- 正確的分級，提供合理的治療

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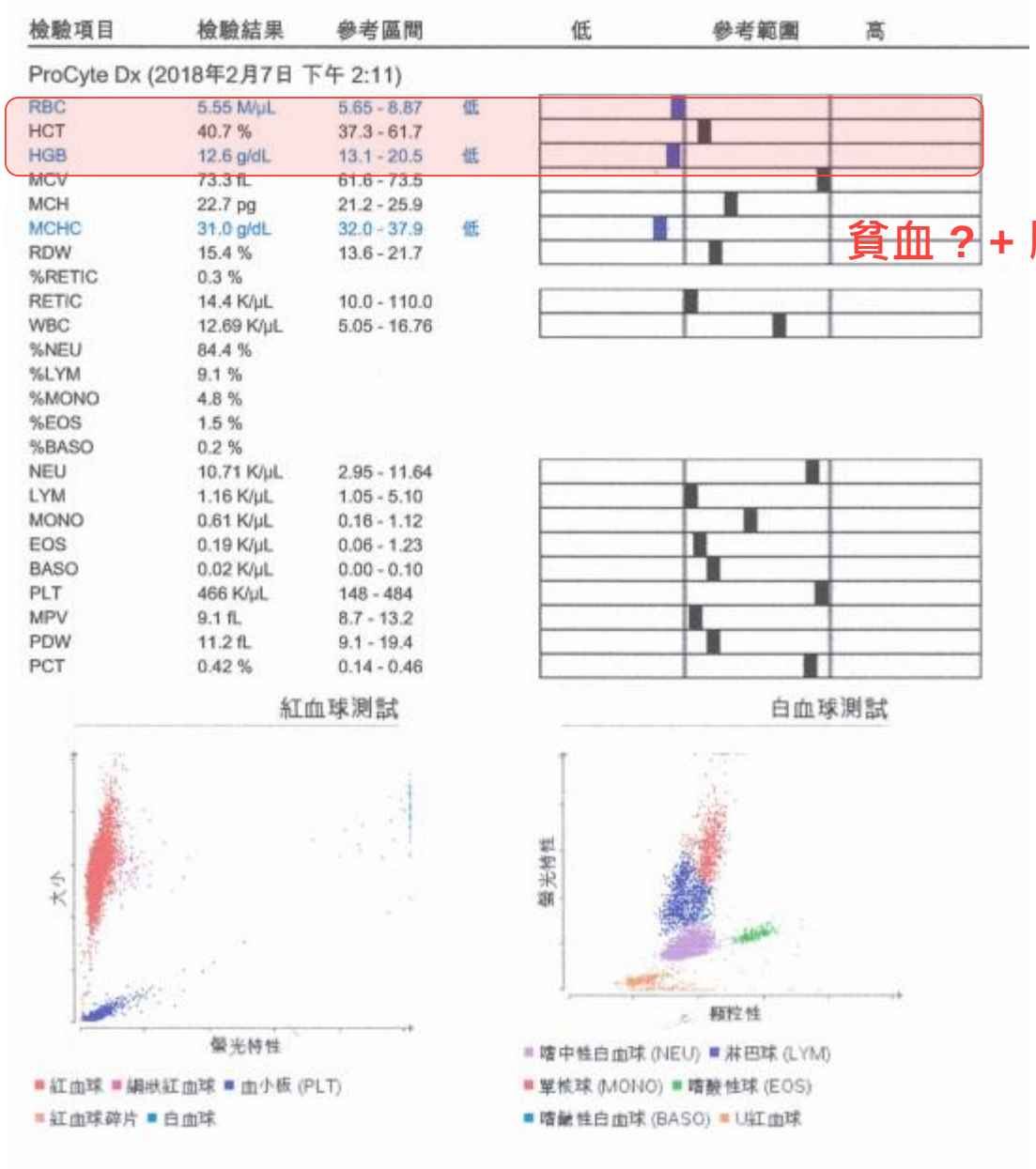
回顧Gaykey的故事...

Case 3 Gaykey 回顧

- 一隻有臨床症狀的狗
- 10歲
- 嘔吐
- 脫水8%
- 黏膜蒼白

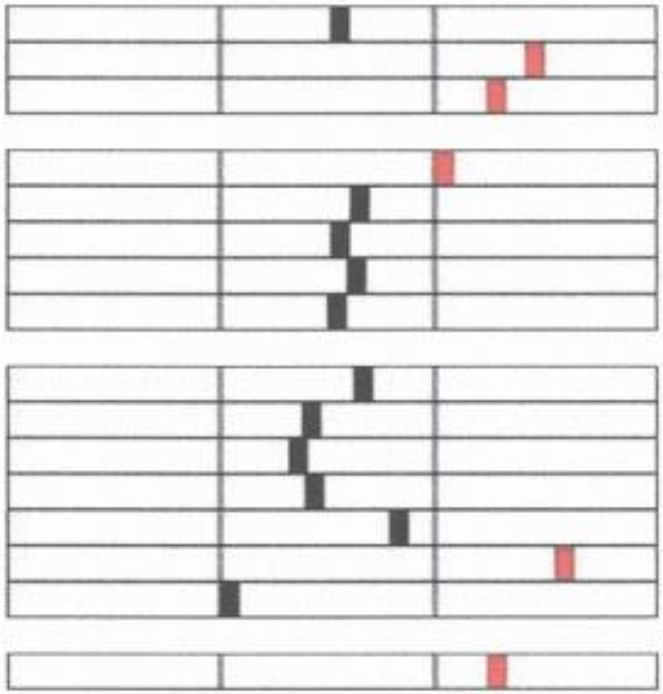


Case 3 Gaykey 回顧

Chem15+ Lyte4 + CRP + SNAP cPL

Catalyst One (2018年2月7日 下午 2:19)

GLU	112 mg/dL	70 - 143	
CREA	3.3 mg/dL	0.5 - 1.8	高
BUN	48 mg/dL	7 - 27	高
BUN/CREA	15		
PHOS	7.5 mg/dL	2.5 - 6.8	高
CA	10.6 mg/dL	7.9 - 12.0	
TP	6.9 g/dL	5.2 - 8.2	
ALB	3.3 g/dL	2.2 - 3.9	
GLOB	3.6 g/dL	2.5 - 4.5	
ALB/GLOB	0.9		
ALT	87 U/L	10 - 125	
ALKP	106 U/L	23 - 212	
GGT	4 U/L	0 - 11	
TBIL	0.4 mg/dL	0.0 - 0.9	
CHOL	285 mg/dL	110 - 320	
Na	166 mmol/L	144 - 160	高
K	3.5 mmol/L	3.5 - 5.8	
Na/K	48		
Cl	130 mmol/L	109 - 122	高
Osm Calc	339 mmol/kg		

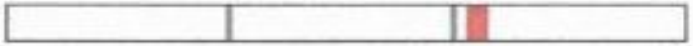


SNAPshot Dx (2018年2月7日 下午 2:37)

cPL	異常

Catalyst One (2018年2月7日 下午 3:36)

CRP	2.0 mg/dL	0.0 - 1.0	高



C-反應蛋白 (CRP): 分析儀的最新分析測試結果已乘以2個總部分的稀釋倍數。

C 反應蛋白 (C-Reactive Protein, CRP)
CRP 濃度 >3.0 mg/dL 指示具有顯著臨床意義的全身性發炎。

血液生化檢測報告到底說些什麼??

Primary

- 針對某一臟器系統的指數
- 找出疾病位置

Secondary

- 也會受到其他系統的影響
- 特異性沒有那麼高
- 對於疾病追蹤 與生理的影響有重要的指標意義。
- 併發症的評估

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血液生化檢測報告到底說些什麼??

Chem17	腎臟 Kidney
GLU	
CREA	●
BUN	●
Phos	●
Ca	●
TP	
ALB	●
ALT	
ALP	
GGT	
Tbil	
CHOL	●
AMYL	
LIPA	

絲球體過清率 (GFR)

腎小管再吸收

腎病症候群 (蛋白質流失)

腎病症候群

Primary

Secondary

100 ved.

IDEXX

血液生化檢測報告到底說些什麼??

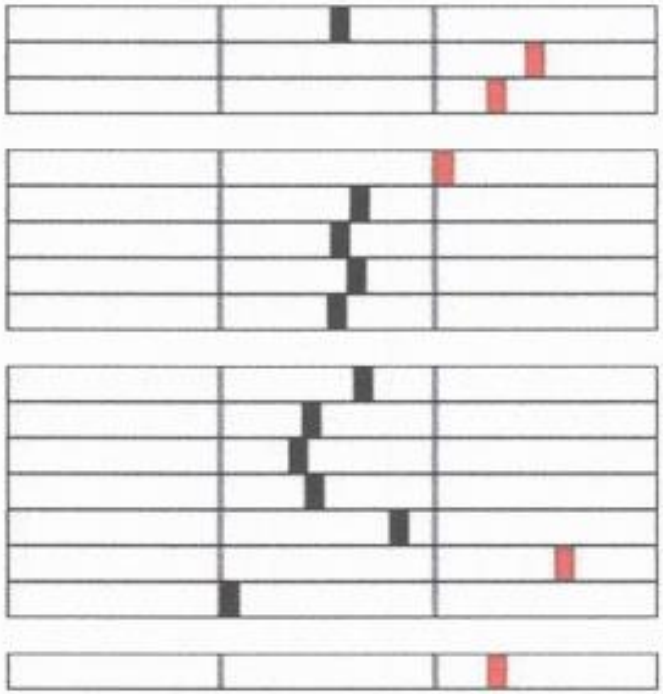
Chem17	腎臟 Kidney	肝臟 Liver	胰臟外分泌 Exo Pancreas	腸道 GI	胰島內分泌 Endocrine Pancreas
GLU		●	●		●
CREA	●		●		●
BUN	●	●		●	
Phos	●				●
Ca	●		●		
TP		●		●	
ALB	●	●	●	●	
ALT		●	●		●
ALP		●	●		●
GGT		●	●		●
Tbil		●	●		
CHOL	●	●	●		●
AMYL			●		●
LIPA			●		●

Case 3 Gaykey 回顧

Chem15+ Lyte4 + CRP + SNAP cPL

Catalyst One (2018年2月7日 下午 2:19)

GLU	112 mg/dL	70 - 143	
CREA	3.3 mg/dL	0.5 - 1.8	高
BUN	48 mg/dL	7 - 27	高
BUN/CREA	15		
PHOS	7.5 mg/dL	2.5 - 6.8	高
CA	10.6 mg/dL	7.9 - 12.0	
TP	6.9 g/dL	5.2 - 8.2	
ALB	3.3 g/dL	2.2 - 3.9	
GLOB	3.6 g/dL	2.5 - 4.5	
ALB/GLOB	0.9		
ALT	87 U/L	10 - 125	
ALKP	106 U/L	23 - 212	
GGT	4 U/L	0 - 11	
TBIL	0.4 mg/dL	0.0 - 0.9	
CHOL	285 mg/dL	110 - 320	
Na	166 mmol/L	144 - 160	高
K	3.5 mmol/L	3.5 - 5.8	
Na/K	48		
Cl	130 mmol/L	109 - 122	高
Osm Calc	339 mmol/kg		

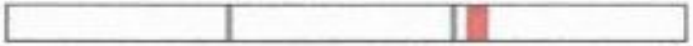


SNAPshot Dx (2018年2月7日 下午 2:37)

cPL	異常

Catalyst One (2018年2月7日 下午 3:36)

CRP	2.0 mg/dL	0.0 - 1.0	高



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C 反應蛋白 (C-Reactive Protein, CRP)
CRP 濃度 >3.0 mg/dL 指示具有顯著臨床意義的全身性發炎。

Case 3 (Gaykey) Feb 7 2018

腎臟檢測組合*			
檢測項目	參考區間	檢測結果	檢測顯示
CREA	0.5-1.8 mg/dL	3.3	腎絲球體過濾率(GFR)
BUN	7-27 mg/dL	48	腎絲球體過濾率(GFR)
SDMA	0-14 ug/dL		腎絲球體過濾率(GFR)
PHOS	2.5-6.8 mg/dL	7.5	腎小管再吸收 (受GFR影響)
CA	7.9-12.0 mg/dL		腎臟內分泌調節 (搭配ALB判讀)
ALB	2.2-3.9 g/dL		腎臟損傷、 蛋白質流失性腎病 (PLN)
CHOL	110-320 mg/dL		腎病症候群、蛋白質流失性腎病 (PLN)

肝臟檢測組合			
檢測項目	參考區間	檢測結果	檢測顯示
ALB	2.2-3.9 g/dL		肝臟合成功能
ALT	10-125 U/L		肝細胞損傷
ALP	23-212 U/L		膽道阻塞
TP	5.2-8.2 g/dL		肝臟合成功能
GGT	0-11 U/L		膽道阻塞
GLU	70-143 mg/dL		肝臟儲存及合成功能
BUN	7-27 mg/dL	48	肝臟合成功能
TBIL	0.0-0.9 mg/dL		瀰漫性肝病、膽道阻塞
CHOL	110-320 mg/dL		肝臟合成功能、膽道阻塞

胰臟檢測組合			
檢測項目	參考區間	檢測結果	檢測顯示
AMYL	500-1500 U/L		胰臟損傷 (搭配腎灌流判讀)
LIPA	200-1800 U/L		胰臟損傷 (搭配腎灌流判讀)
CREA	0.5-1.8 mg/dL	3.3	腎絲球體過濾率(GFR)
GLU	70-143 mg/dL		併發症 (病灶區鈣化))(搭配ALB判讀)
CA	7.9-12.0 mg/dL		併發症 (系統性炎症反應、脫水)
ALB	2.2-3.9 g/dL		併發症 (病灶區鈣化)(搭配ALB判讀)
ALT	10-125 U/L		併發症 (肝炎)
ALP	23-212 U/L		併發症 (肝炎、膽管炎)
GGT	0-11 U/L		併發症 (肝炎、膽管炎)
TBIL	0.0-0.9 mg/dL		併發症 (肝炎、膽管炎)
CHOL	110-320 mg/dL		併發症 (肝炎、膽管炎)

腸胃檢測組合*			
檢測項目	參考區間	檢測結果	檢測顯示
TP	5.2-8.2 g/dL		腸道炎症造成體液流失(搭配ALB評估)
ALB	2.2-3.9 g/dL		腸道炎症造成體液流失、吸收不良
BUN	7-27 mg/dL	48	消化道出血

胰島檢測組合*			
檢測項目	參考區間	檢測結果	檢測顯示
GLU	70-143 mg/dL		調控異常
CREA	0.5-1.8 mg/dL	3.3	腎絲球體過濾率(GFR)、脫水
PHOS	2.5-6.8 mg/dL	7.5	併發血磷調控異常
ALT	10-125 U/L		併發脂肪肝
ALP	23-212 U/L		併發脂肪肝、膽道阻塞
GGT	0-11 U/L		併發脂肪肝、膽道阻塞
CHOL	110-320 mg/dL		併發脂肪肝、膽道阻塞
AMYL	500-1500 U/L		評估潛在胰臟疾病 (搭配Crea評估)
LIPA	200-1800 U/L		評估潛在胰臟疾病 (搭配Crea評估)

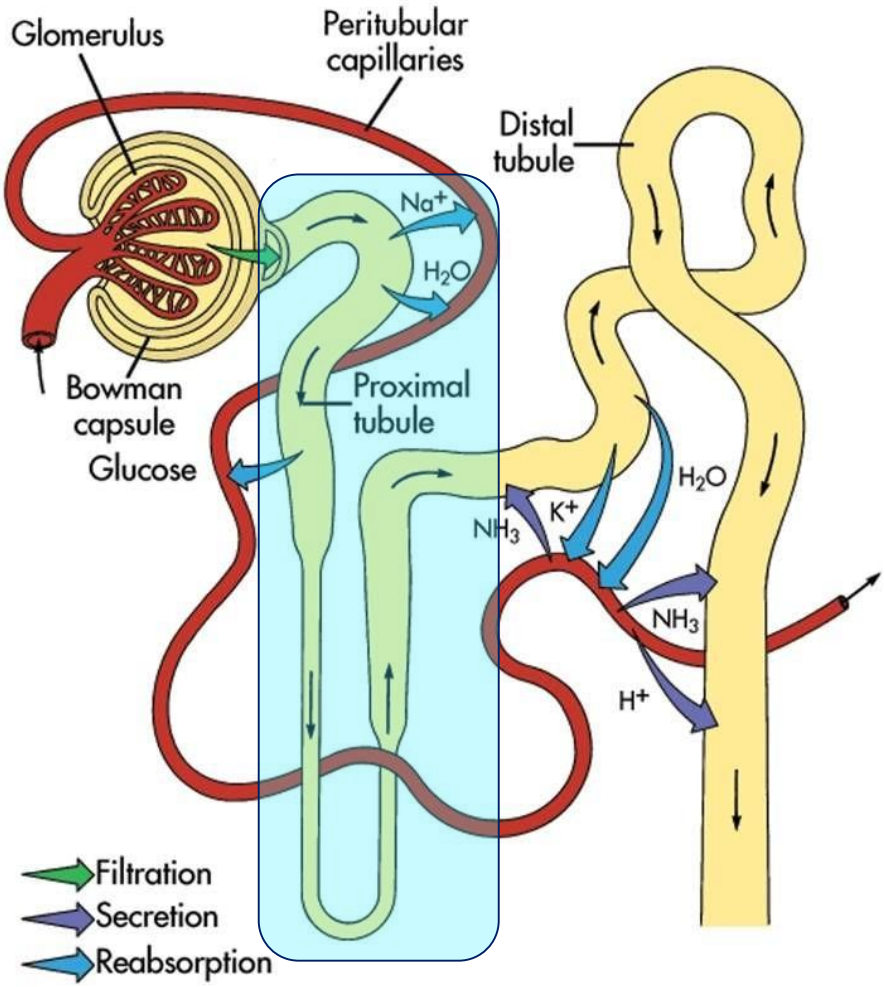
- USG: 1.013

- SNAP cPL: abnormal
- CRP: 2 mg/dL

IDEXX

腎功能的評估: 腎小管 再吸收 功能

腎臟產生 等比重尿，已喪失調節水合的能力!!!



(From Thibodeau GA, Patton KT: *Anatomy & physiology,* ed 5, St Louis, 2003, Mosby.)

- **尿比重 USG(折光計)**
  - 反應腎臟對尿液加工的能力
  - 血漿比重: 1.008 ~ 1.012 (等比重尿)
  - 正常尿比重

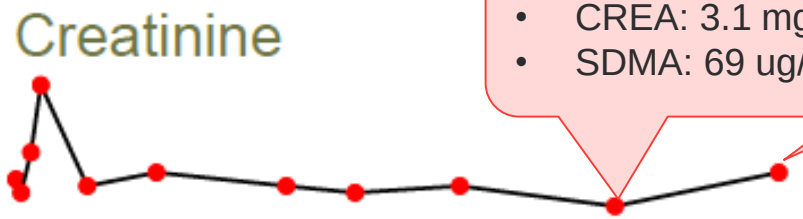
狗: >1.030

貓: >1.035

Case 3 Gaykey 回顧

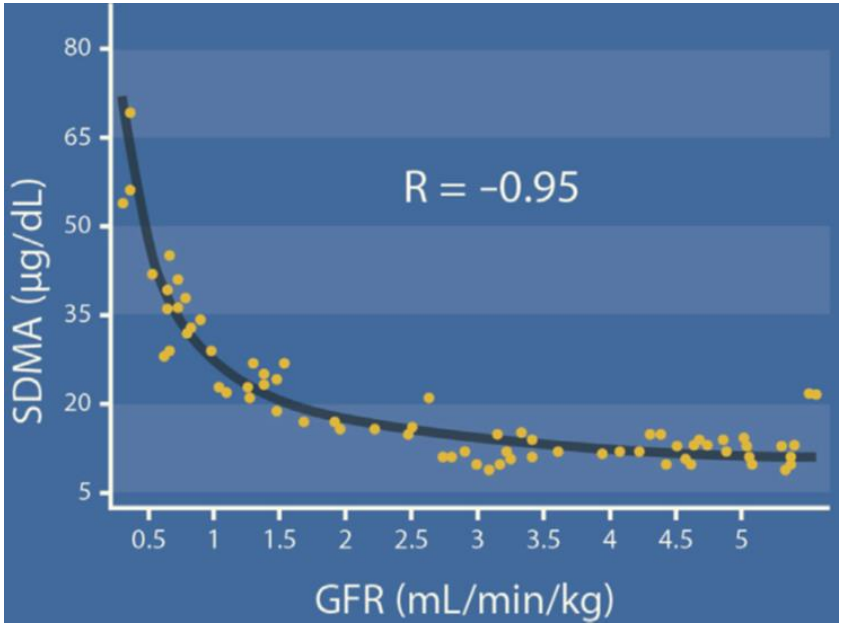
Jun 8 2018:
- CREA: 3.1 mg/dL
- SDMA: 69 ug/dL

Jun 11 2018:
- CREA: 3.6 mg/dL
- SDMA: 61 ug/dL



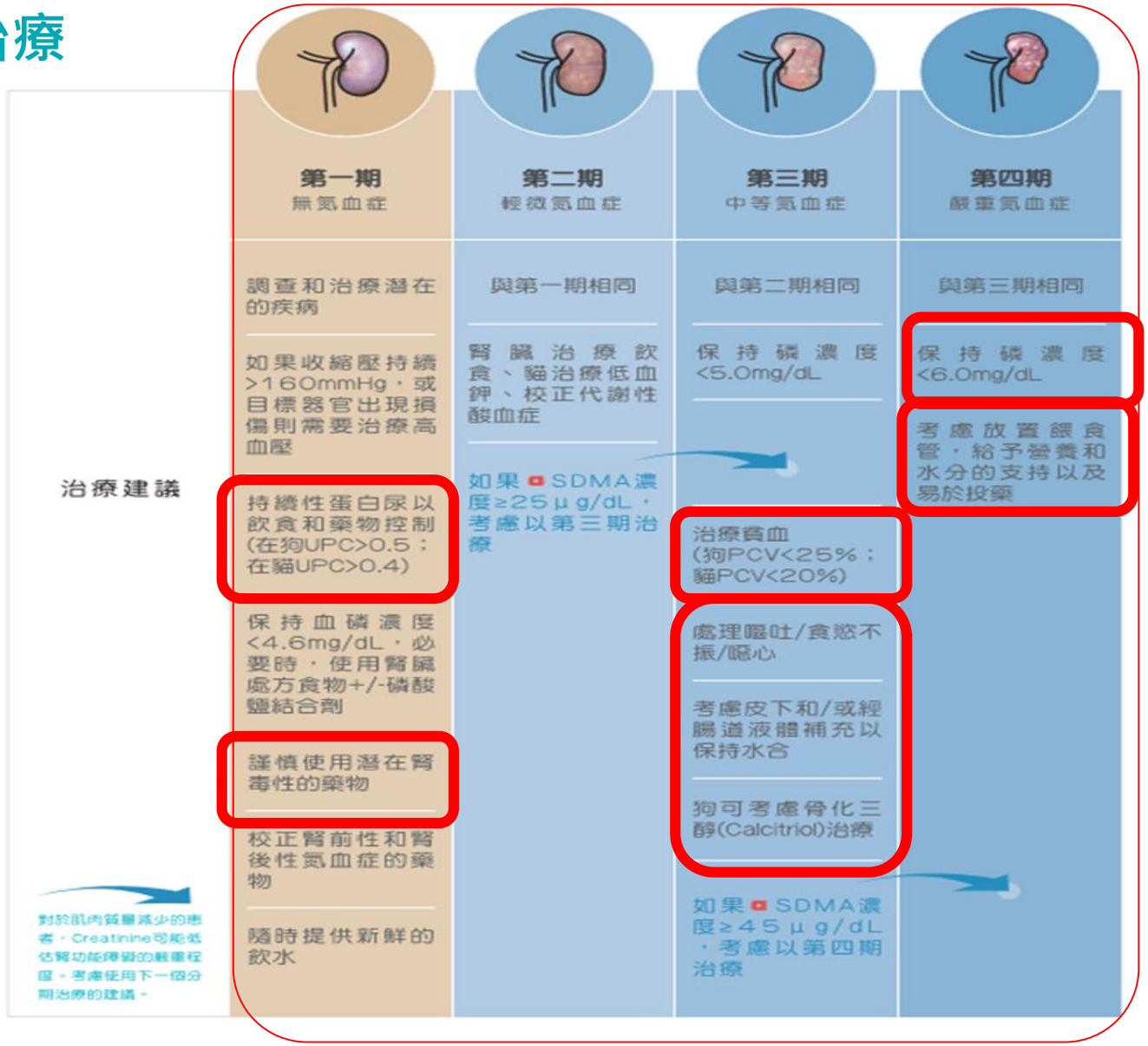
USG: 1.013

USG: 1.008



Case 3 Gaykey 治療監控要點

Step 3: 治療



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Case 3 Gaykey 回顧

Chemistry	7/11/18 11:27 AM	7/11/18 11:12 AM		
Glucose		129	70 - 143 mg/dL	
IDEXX SDMA Learn More	[a] 61			
Creatinine		3.6	0.5 - 1.8 mg/dL	
BUN		48	7 - 27 mg/dL	
BUN: Creatinine Ratio		14		
Phosphorus		4.8	2.5 - 6.8 mg/dL	
Calcium		11.1	7.9 - 12.0 mg/dL	
Sodium		149	144 - 160 mmol/L	
Potassium		4.5	3.5 - 5.8 mmol/L	
Na: K Ratio		33		
Chloride		110	109 - 122 mmol/L	
Total Protein		7.4	5.2 - 8.2 g/dL	
Albumin		2.8	2.2 - 3.9 g/dL	
Globulin		4.5	2.5 - 4.5 g/dL	
Albumin: Globulin Ratio		0.6		
ALT		81	10 - 125 U/L	
ALP		286	23 - 212 U/L	
GGT		2	0 - 11 U/L	
Bilirubin - Total		0.4	0.0 - 0.9 mg/dL	
Cholesterol		451	110 - 320 mg/dL	
Amylase		1,059	500 - 1,500 U/L	
Lipase		510	200 - 1,800 U/L	
Osmolality		309	mmol/kg	

Case 3 (Gaykey) Jul 11 2018

腎臟檢測組合*			
檢測項目	參考區間	檢測結果	檢測顯示
CREA	0.5-1.8 mg/dL	3.6	腎絲球體過濾率(GFR)
BUN	7-27 mg/dL	48	腎絲球體過濾率(GFR)
SDMA	0-14 ug/dL		腎絲球體過濾率(GFR)
PHOS	2.5-6.8 mg/dL	4.8 ← 7.5	腎小管再吸收 (受GFR影響)
CA	7.9-12.0 mg/dL		腎臟內分泌調節 (搭配ALB判讀)
ALB	2.2-3.9 g/dL		腎臟損傷、 蛋白質流失性腎病 (PLN)
CHOL	110-320 mg/dL	451	腎病症候群、蛋白質流失性腎病 (PLN)

腸胃檢測組合*			
檢測項目	參考區間	檢測結果	檢測顯示
TP	5.2-8.2 g/dL		腸道炎症造成體液流失(搭配ALB評估)
ALB	2.2-3.9 g/dL		腸道炎症造成體液流失、吸收不良
BUN	7-27 mg/dL	48	消化道出血

- USG: 1.008
- SDMA: 61

肝臟檢測組合			
檢測項目	參考區間	檢測結果	檢測顯示
ALB	2.2-3.9 g/dL		肝臟合成功能
ALT	10-125 U/L		肝細胞損傷
ALP	23-212 U/L	286	膽道阻塞
TP	5.2-8.2 g/dL		肝臟合成功能
GGT	0-11 U/L		膽道阻塞
GLU	70-143 mg/dL		肝臟儲存及合成功能
BUN	7-27 mg/dL	48	肝臟合成功能
TBIL	0.0-0.9 mg/dL		瀰漫性肝病、膽道阻塞
CHOL	110-320 mg/dL	451	肝臟合成功能、膽道阻塞

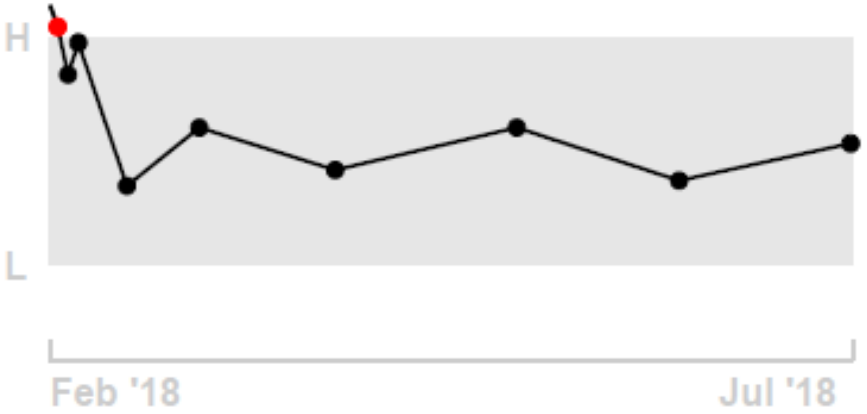
胰島檢測組合*			
檢測項目	參考區間	檢測結果	檢測顯示
GLU	70-143 mg/dL		調控異常
CREA	0.5-1.8 mg/dL	3.6	腎絲球體過濾率(GFR)、脫水
PHOS	2.5-6.8 mg/dL	4.8 ←7.5	併發血磷調控異常
ALT	10-125 U/L		併發脂肪肝
ALP	23-212 U/L	286	併發脂肪肝、膽道阻塞
GGT	0-11 U/L		併發脂肪肝、膽道阻塞
CHOL	110-320 mg/dL	451	併發脂肪肝、膽道阻塞
AMYL	500-1500 U/L		評估潛在胰臟疾病 (搭配Crea評估)
LIPA	200-1800 U/L		評估潛在胰臟疾病 (搭配Crea評估)

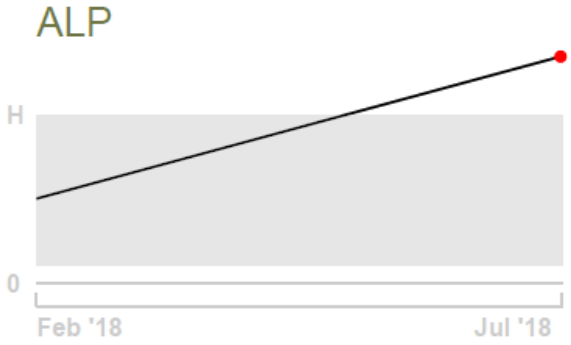
胰臟檢測組合			
檢測項目	參考區間	檢測結果	檢測顯示
AMYL	500-1500 U/L		胰臟損傷 (搭配腎灌流判讀)
LIPA	200-1800 U/L		胰臟損傷 (搭配腎灌流判讀)
CREA	0.5-1.8 mg/dL	3.6	腎絲球體過濾率(GFR)
GLU	70-143 mg/dL		併發症 (病灶區鈣化))(搭配ALB判讀)
CA	7.9-12.0 mg/dL		併發症 (系統性炎症反應、脫水)
ALB	2.2-3.9 g/dL		併發症 (病灶區鈣化)(搭配ALB判讀)
ALT	10-125 U/L		併發症 (肝炎)
ALP	23-212 U/L	286	併發症 (肝炎、膽管炎)
GGT	0-11 U/L		併發症 (肝炎、膽管炎)
TBIL	0.0-0.9 mg/dL		併發症 (肝炎、膽管炎)
CHOL	110-320 mg/dL	451	併發症 (肝炎、膽管炎)

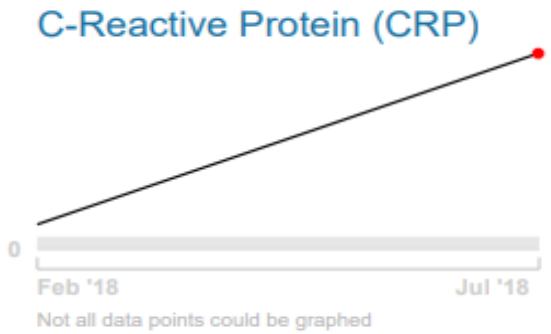
- SNAP cPL: normal
- CRP: 16.3 mg/dL

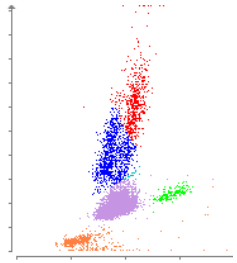
IDEXX

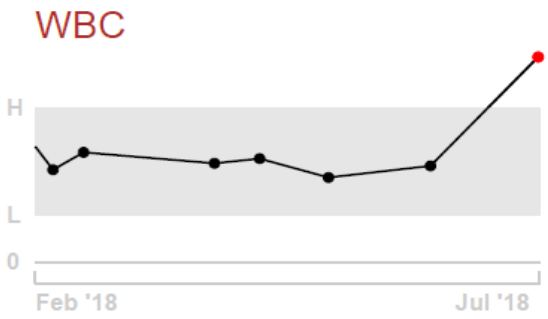
Case 3 Gaykey 回顧

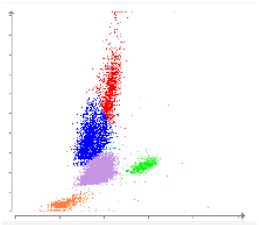












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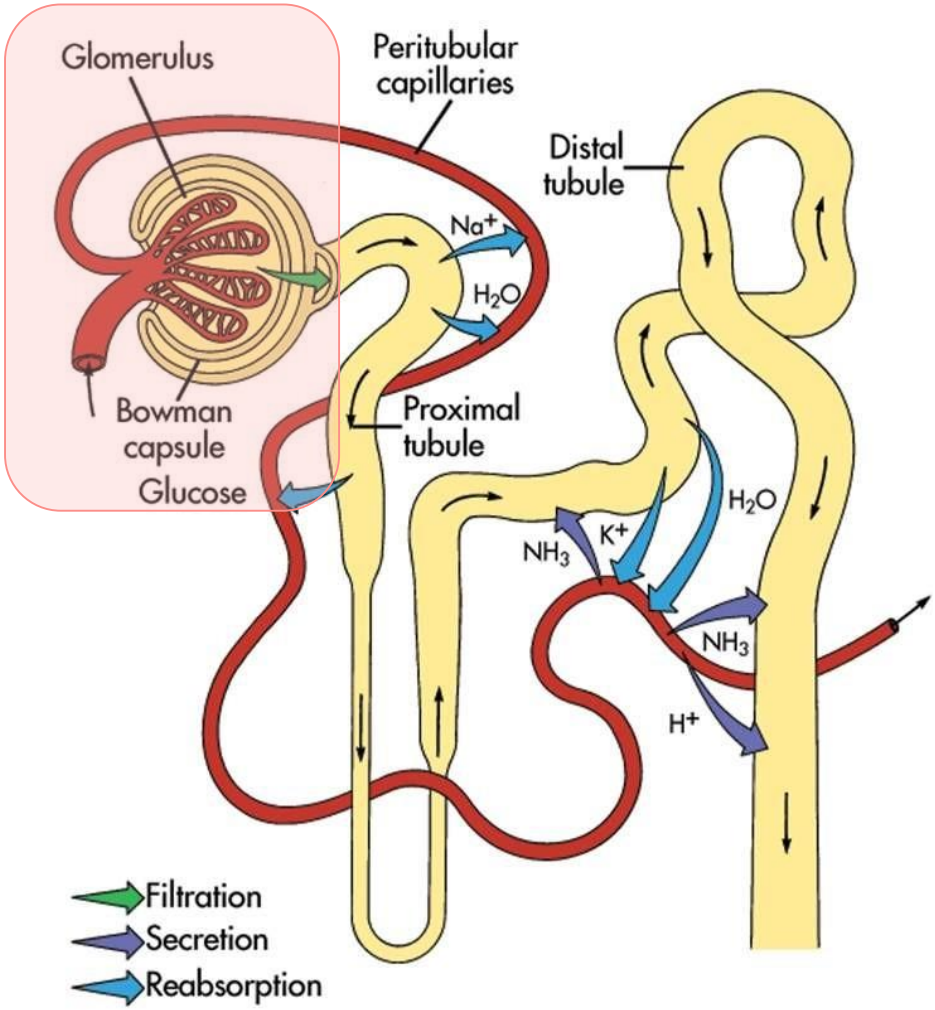
Case 3 Gaykey 回顧

Urinalysis

TEST	RESULT	REFERENCE VALUE	7/11/18 11:45 AM	2/8/18 10:01 AM
Collection	Cystocentesis			Cystocente...
Color	Straw			Straw
Clarity	Clear			Clear
Specific Gravity	1.008			1.013
pH	6.5			6.0
Urine Protein	30	mg/dL		30
Glucose	300	mg/dL		100
Ketones	neg			neg
Blood / Hemoglobin	250	Ery/µL		250
Bilirubin	neg			neg
Urobilinogen	norm			norm
Leukocyte Esterase	neg			neg

TEST	RESULT	REFERENCE VALUE	
Urine Creatinine	28	mg/dL	33
Urine Protein	79	mg/dL	62
Urine Protein: Creatinine Ratio	2.85		1.89

腎損傷的評估:



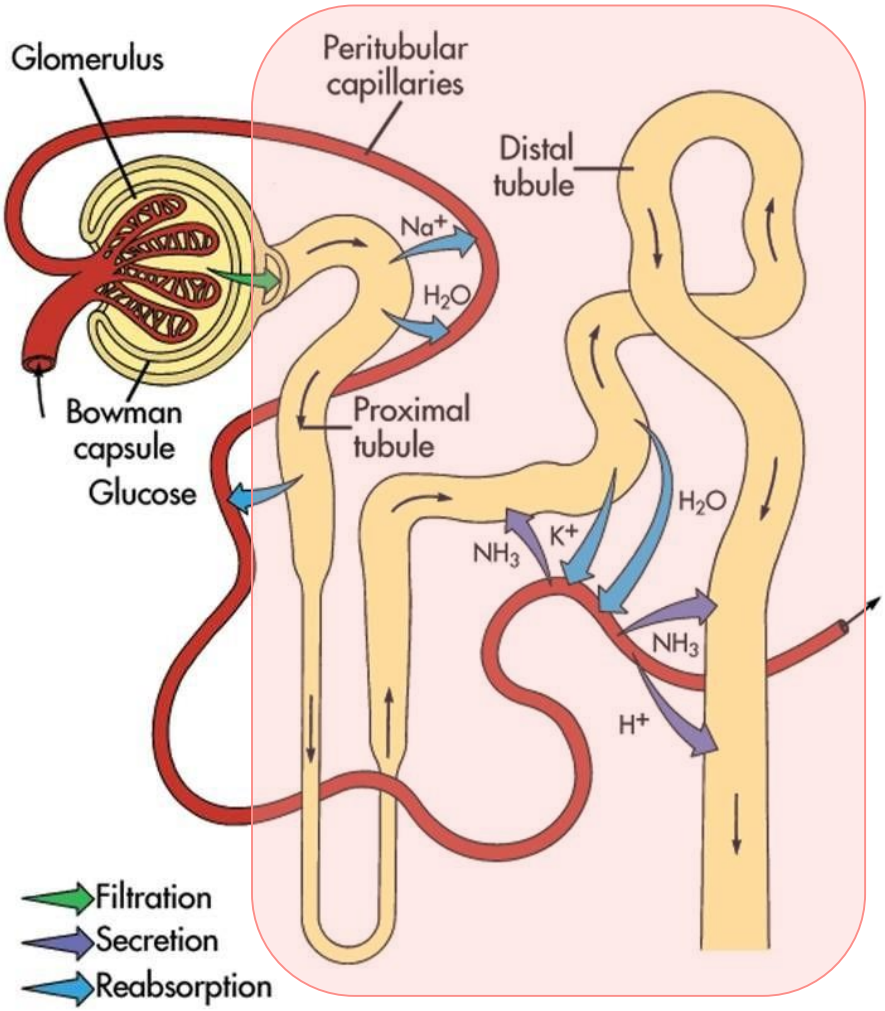
(From Thibodeau GA, Patton KT: *Anatomy & physiology,* ed 5, St Louis, 2003, Mosby.)

- **蛋白尿 (絲球體)**
  - 免疫附合體沉著
  - 絲球體腎炎
  - 類澱粉沉著

ALB 由尿液流失，是對動物最嚴重的損害。

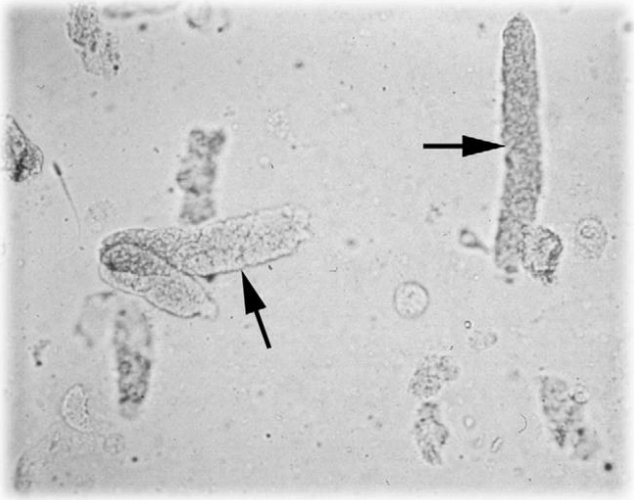
持續絲球體腎炎，會導致腎元壞死。

腎損傷的評估:

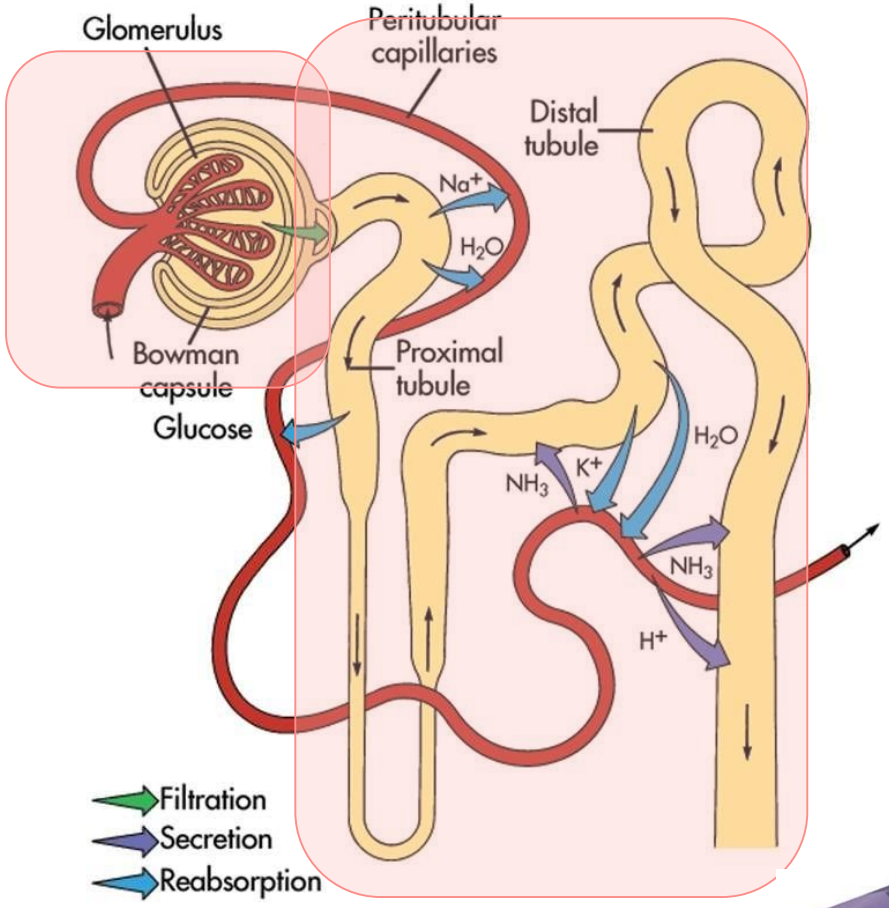


(From Thibodeau GA, Patton KT: *Anatomy & physiology,* ed 5, St Louis, 2003, Mosby.)

- **蛋白尿 (腎小管)**
  - 急性腎小管損傷
  - 腎毒性物質
  - 缺氧造成壞死
  - 炎症
  - 上行性感染



腎損傷的評估: 絲球體損傷、腎小管功能



(From Thibodeau GA, Patton KT: *Anatomy & physiology,* ed 5, St Louis, 2003, Mosby.)

- 尿液化學組成 (尿液試條紙)
  - 尿蛋白 (protein):

需搭配尿比重，進行判讀評估。

- UPC (定量尿蛋白)
  - Upro/Ucrea
  - 用於診斷、追蹤

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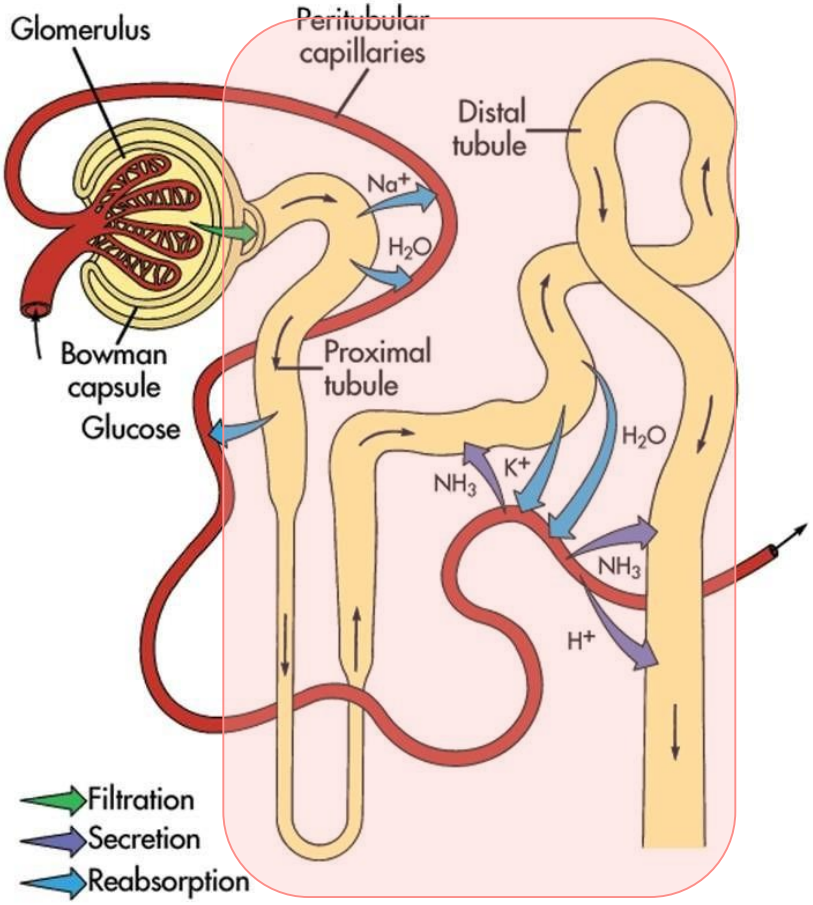
腎損傷的評估: 腎小管損傷



(From Thibodeau GA, Patton KT: *Anatomy & physiology,* ed 5, St Louis, 2003, Mosby.)

- **尿液化學組成 (尿液試條紙)**
  - **尿糖 (glucose):**
    - 腎小管再吸收功能喪失
    - 血糖過高
    - 短暫高血糖
  - **酸鹼 (pH):** 酸鹼調控
    - pH 5.0 ~ 7.0
    - 與血中 pH相關性

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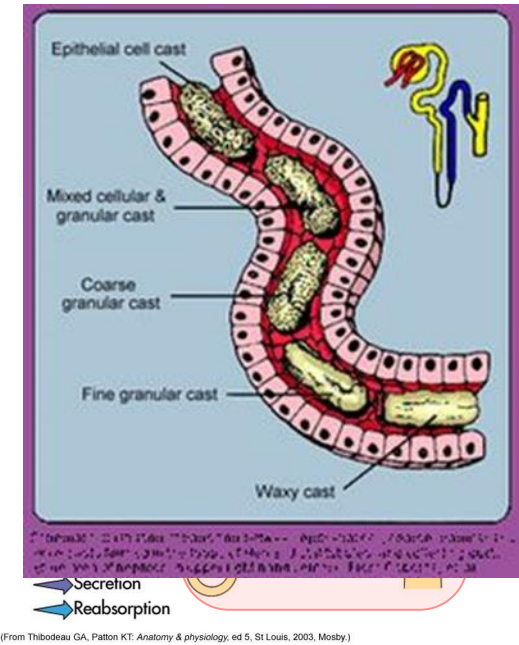
腎功能的評估: 腎小管損傷、炎症

- **尿渣檢查 (顯微鏡檢)**
  - 尿圓柱(Cast): 脫落的細胞堆積在腎小管內。



(From Thibodeau GA, Patton KT: *Anatomy & physiology*, ed 5, St Louis, 2003, Mosby.)

需搭配尿比重，進行判讀評估。

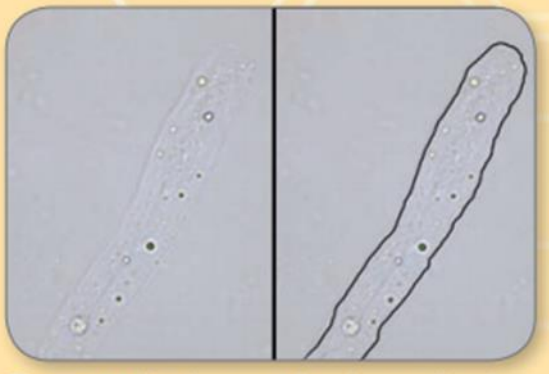


Figure 13 Hyaline cast (borders outlined)

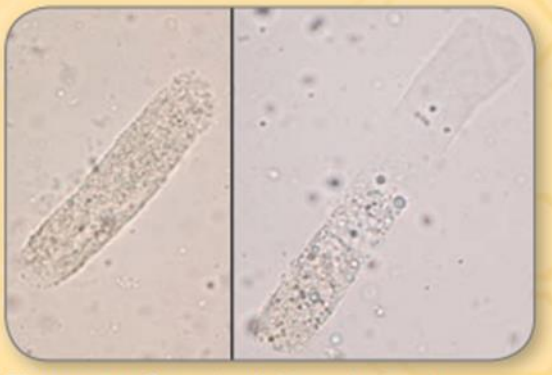


Figure 14 Granular (left) and mixed waxy and granular (right) casts


Figure 15 Waxy cast

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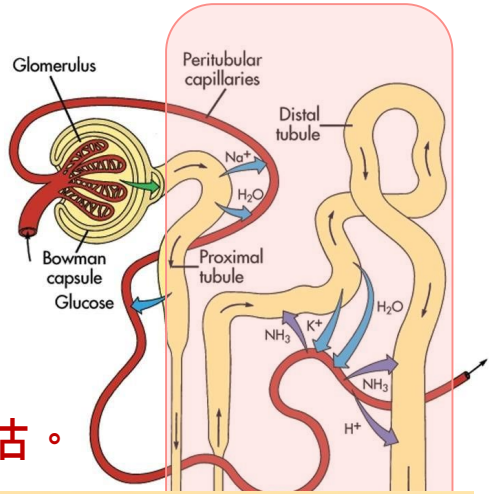
腎功能的評估: 腎小管損傷、炎症

- **尿渣檢查 (顯微鏡檢)**
  - 紅血球:炎症反應導致的出血
  - 白血球:炎症反應
  - 細菌: 感染



需搭配尿比重，進行判讀評估。

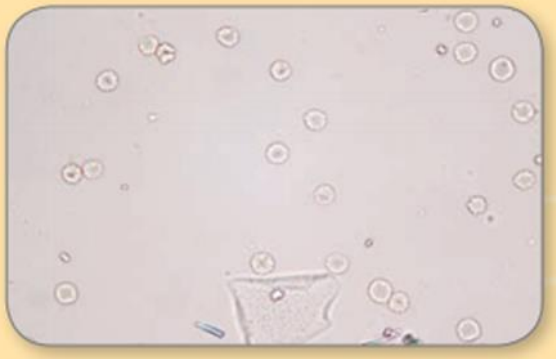


Figure 1 Erythrocytes and one squamous epithelial cell

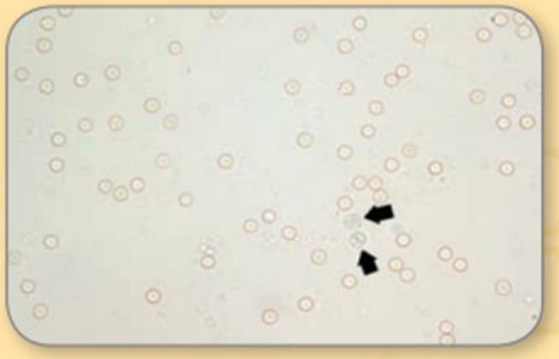


Figure 2 Erythrocytes and two leukocytes (black arrows)

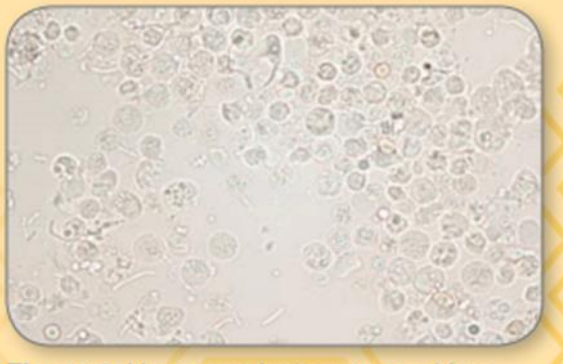


Figure 3 Numerous leukocytes and few rod-shaped bacteria

Figure 4 Many rod-shaped bacteria 100x objective field of view

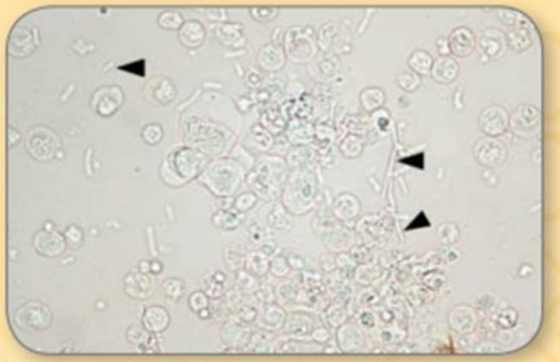


Figure 5 Many leukocytes and large rod-shaped bacteria (black arrowheads)

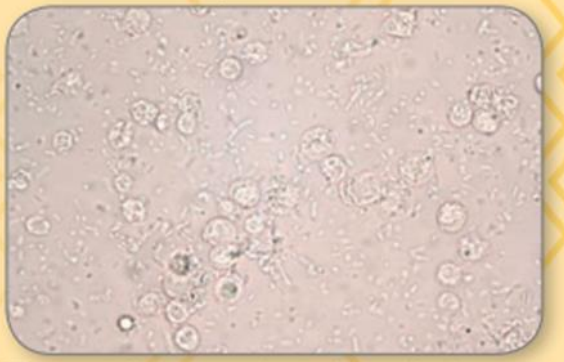


Figure 6 Numerous bacteria and leukocytes

Case 3 Gaykey 回顧

盡可能維持動物與主人的生活品質，透過:

1. 完善的監控。

2. 適當的處置計畫，控制症狀和可能併發症。

3. 清楚的溝通，理解主人的期待。

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Q&A

Case 4 柑

- 10y/o 黃金獵犬，MN
- Unclear CKD history for several years.
- Normal ASUD and on k/d diet.
- PE: BCS: 8/9, well-hydration

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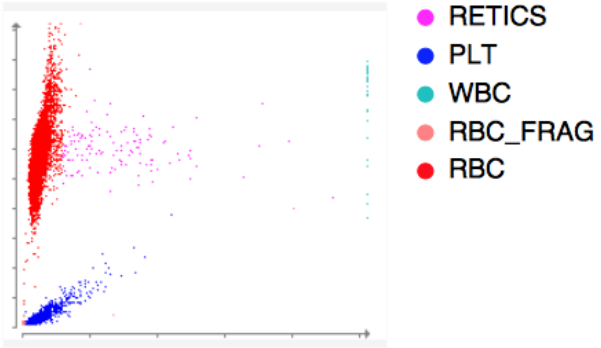
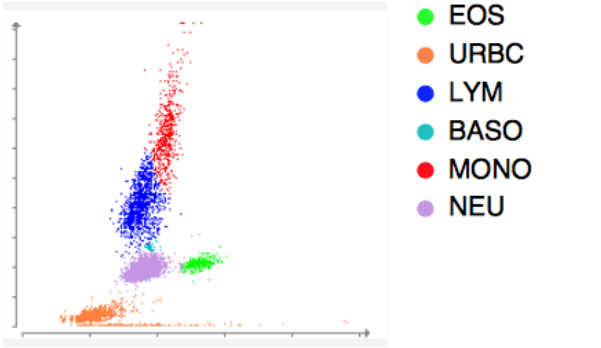
Hematology

3/7/18 3:11 PM

TEST	RESULT	REFERENCE VALUE
RBC	7.38	5.65 - 8.87 M/µL
Hematocrit	46.1	37.3 - 61.7 %
Hemoglobin	16.1	13.1 - 20.5 g/dL
MCV	62.5	61.6 - 73.5 fL
MCH	21.8	21.2 - 25.9 pg
MCHC	34.9	32.0 - 37.9 g/dL
RDW	19.6	13.6 - 21.7 %
% Reticulocyte	0.5	%
Reticulocyte	38.4	10 - 110 K/µL
WBC	7.9	5.05 - 16.76 K/µL
% Neutrophil	69.6	%
% Lymphocyte	18.0	%
% Monocyte	7.5	%
% Eosinophil	4.4	%
% Basophil	0.5	%
Neutrophil	5.5	2.95 - 11.64 K/µL
Lymphocyte	1.42	1.05 - 5.1 K/µL
Monocyte	0.59	0.16 - 1.12 K/µL
Eosinophil	0.35	0.06 - 1.23 K/µL
Basophil	0.04	0 - 0.1 K/µL
Platelet	413	148 - 484 K/µL
PDW	14.6	9.1 - 19.4 fL
MPV	10.3	8.7 - 13.2 fL
Plateletcrit	0.43	0.14 - 0.46 %



Download



Download

Chemistry

3/7/18
3:20 PM

Glucose	99	70 - 143 mg/dL
Creatinine	1.2	0.5 - 1.8 mg/dL
BUN	13	7 - 27 mg/dL
BUN: Creatinine Ratio	11	
Phosphorus	3.7	2.5 - 6.8 mg/dL
Calcium	11.0	7.9 - 12.0 mg/dL
Sodium	152	144 - 160 mmol/L
Potassium	4.0	3.5 - 5.8 mmol/L
Na: K Ratio	39	
Chloride	114	109 - 122 mmol/L
Total Protein	7.6	5.2 - 8.2 g/dL
Albumin	3.4	2.2 - 3.9 g/dL
Globulin	4.2	2.5 - 4.5 g/dL
Albumin: Globulin Ratio	0.8	
ALT	63	10 - 125 U/L
ALP	85	23 - 212 U/L

©

GGT	0	0 - 11 U/L	
Bilirubin - Total	0.2	0.0 - 0.9 mg/dL	
Cholesterol	271	110 - 320 mg/dL	
Amylase	1,093	500 - 1,500 U/L	
Lipase	**2,571**	200 - 1,800 U/L	
Osmolality	301	mmol/kg	
SNAP cPL	normal		

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三個月後回診

- 左前肢傷口回診
- 更胖了～～
- 飼主想更改飼料

Chemistry	6/26/18 11:29 AM		
IDEXX SDMA Learn More	[a] 10	0 - 14 µg/dL	
Creatinine	1.7	0.5 - 1.8 mg/dL	
BUN	13	7 - 27 mg/dL	
BUN: Creatinine Ratio	7		
Phosphorus	4.5	2.5 - 6.8 mg/dL	

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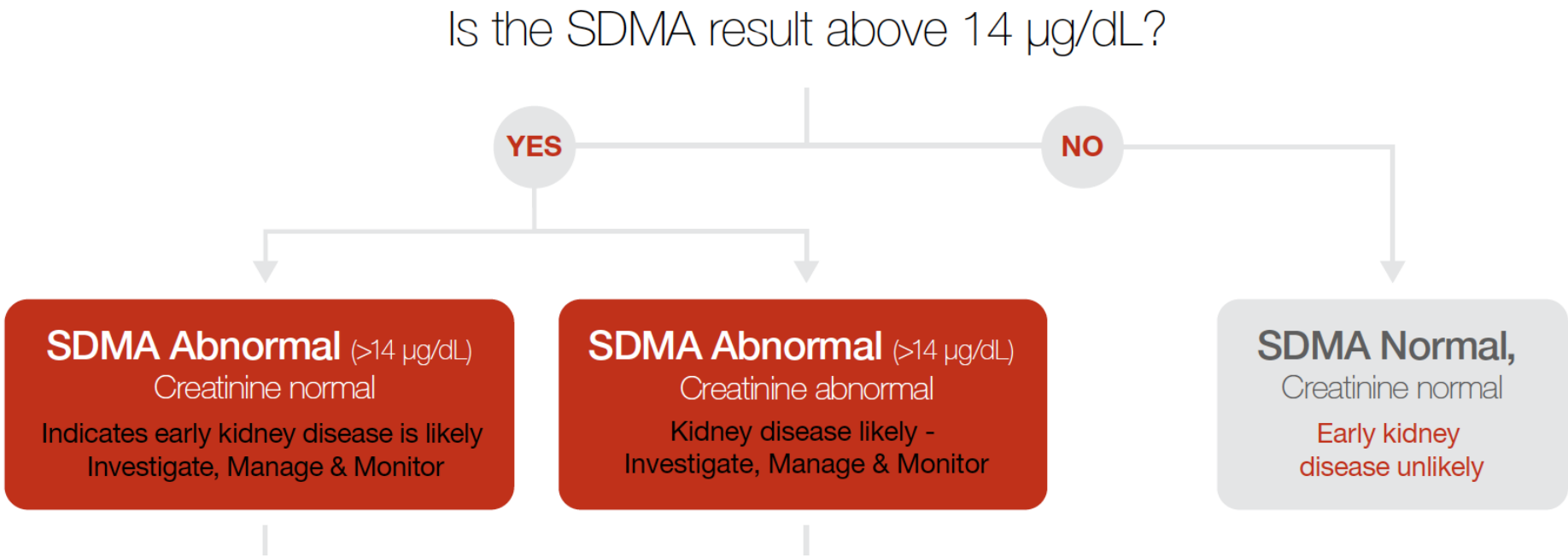

如果 SDMA 及肌酸酐 (Creatinine) 兩者都落在參考區間內，那麼腎臟功能則可能是良好的。請評估完整的尿液分析並確認這裡沒有任何其他腎臟疾病的證據。

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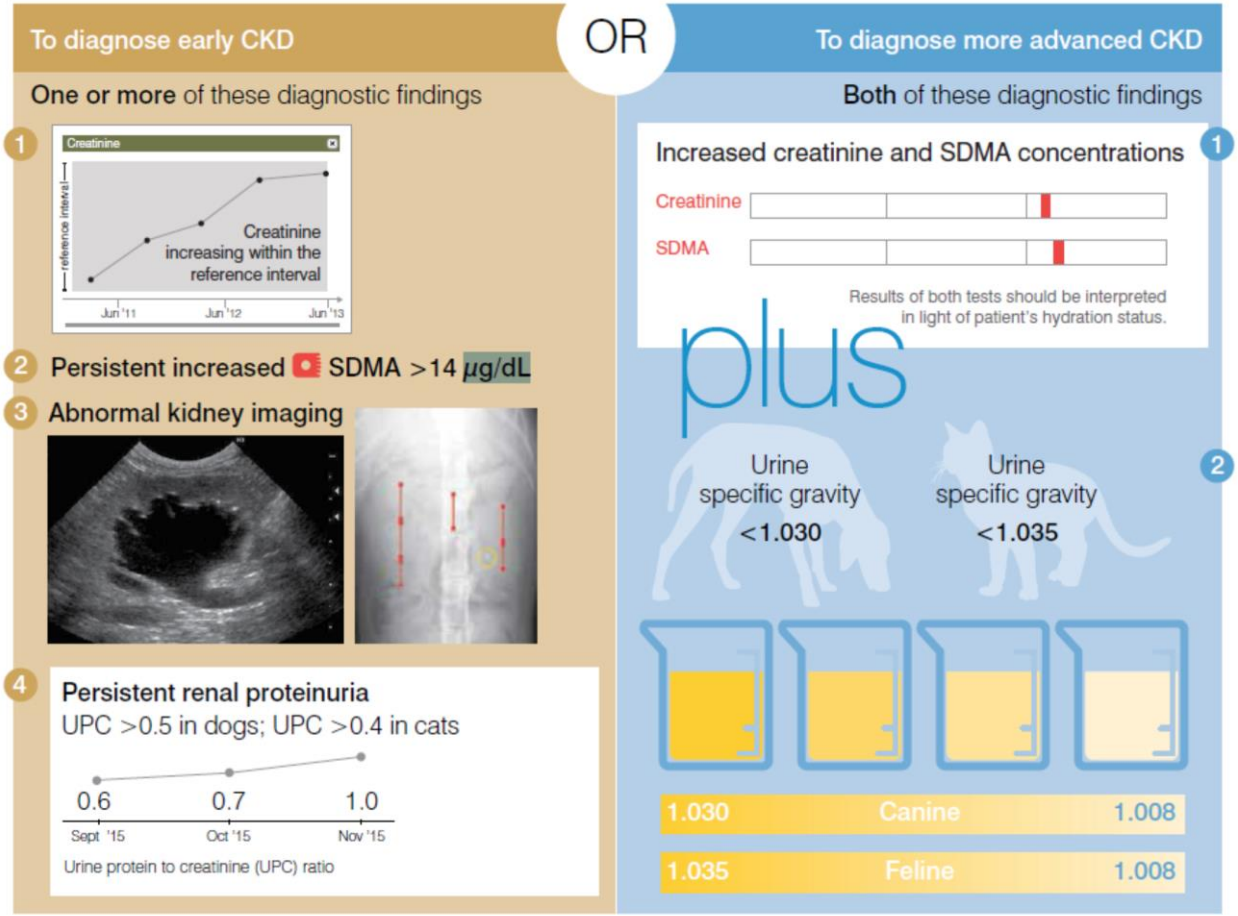
下一步建議

- 完整尿液檢查
- UPC
- 影像學上診斷



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DOG Nutrient Dry Matter %	RF14	Farmina renal	k/d® + Mobility	k/d® Canine	g/d® Canine	h/d® Canine	Adult Original	Adult 7+ Original
Caloric content	3988	3781	4068	4050	3634	4129	3659	3666
Protein	14	13.0	15.3	15.5	18.3	18.5	24.5	19.6
Fat	18	15	23.6	23.0	11.3	20.6	15.0	14.9
Crude Fiber	3.4	1.4	3.9	1.7	0.9	1.9	2.2	2.4
Carbohydrate / NFE	47.1		53	54.5	65.3	54.5	52.7	58.0
Calcium	0.4	0.6	0.62	0.86	0.59	0.70	1.00	0.79
Phosphorous	0.2	0.25	0.29	0.33	0.43	0.53	0.74	0.67
Sodium	0.35	0.15	0.19	0.19	0.20	0.08	0.30	0.26
Potassium	0.6	0.60	0.68	0.84	0.71	0.80	0.70	0.70
Magnesium	0.09	0.06	0.121	0.144	0.077	0.122	0.114	0.120
Taurine						0.14	0.11	
Carnitine			226.0ppm					
Vitamin E			563 IU/kg	730 IU/kg	261 IU/kg	606 IU/kg	729 IU.kg	748 IU/kg
Vitamin C			92 PPm	126ppm		255ppm	304ppm	280ppm
Total Omega-3 FA		0.5	3.81	0.95	0.83		0.64	0.48

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柚子 小總結

- Cre 正常，SDMA 正常
- 腎臟疾病的正確的診斷很重要
- 診斷了？追蹤嗎？
- 腎臟飲食的介入時機
- 多一個診斷工具，增加診斷信心

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四種情境

如果 SDMA 及肌酸酐 (Creatinine) 兩者都落在參考區間內，那麼腎臟功能則可能是良好的。請評估完整的尿液分析並確認這裡沒有任何其他腎臟疾病的證據。

如果 SDMA 升高，但是肌酸酐卻落在參考區間內。SDMA 檢測相較於肌酸酐是一種更敏銳的腎臟功能指標，因為 SDMA 早期偵測腎臟功能下降，且不受肌肉發達影響。肌酸酐可能錯失早期功能喪失，且在肌肉不發達的患病動物中錯誤減少。SDMA 在急性和主動性損傷，以及慢性腎臟病中增加。應該進行一個完整的尿液分析以評估不當比重、蛋白尿及其他腎臟疾病的證據。有關建議行動的資訊，請瀏覽 idexx.com/SDMAalgorithm。

如果 SDMA 落在參考區間內並且肌酸酐值是升高的。這種結果組合不常見。SDMA 和肌酸酐可能同時受生物及檢測變異性影響，導致在參考區間上限附近波動；這可在管理良好的穩定慢性腎臟病發現，且結果可能與疾病惡化一致。肝臟功能正常、肌肉發達的狗，其肌酸酐值可能會超過參考區間值。肌酸酐可在餐後人為增加。如果仍懷疑有腎臟疾病，應該於所有患病動物進行一個完整的尿液分析以評估不當比重、蛋白尿或其他腎臟疾病的證據。

如果 SDMA 及肌酸酐兩者都呈現升高狀態，那麼可能有腎臟疾病且應採取行動。應該進行一個完整的尿液分析以評估不當尿比重、蛋白尿或其他腎臟疾病的證據。有關建議行動的資訊，請瀏覽 idexx.com/SDMAalgorithm。

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New
kidney function
test:
SDMA

SDMA

貓咪提早了48個月偵測出

48個月

狗狗提早了27個月偵測出

27個月

SDMA最早可為貓咪提早48個月偵測到腎臟病；並為狗狗提早27個月偵測到腎臟病，讓您有更充裕的時間來調理狗貓的狀況，並提供有效的治療。

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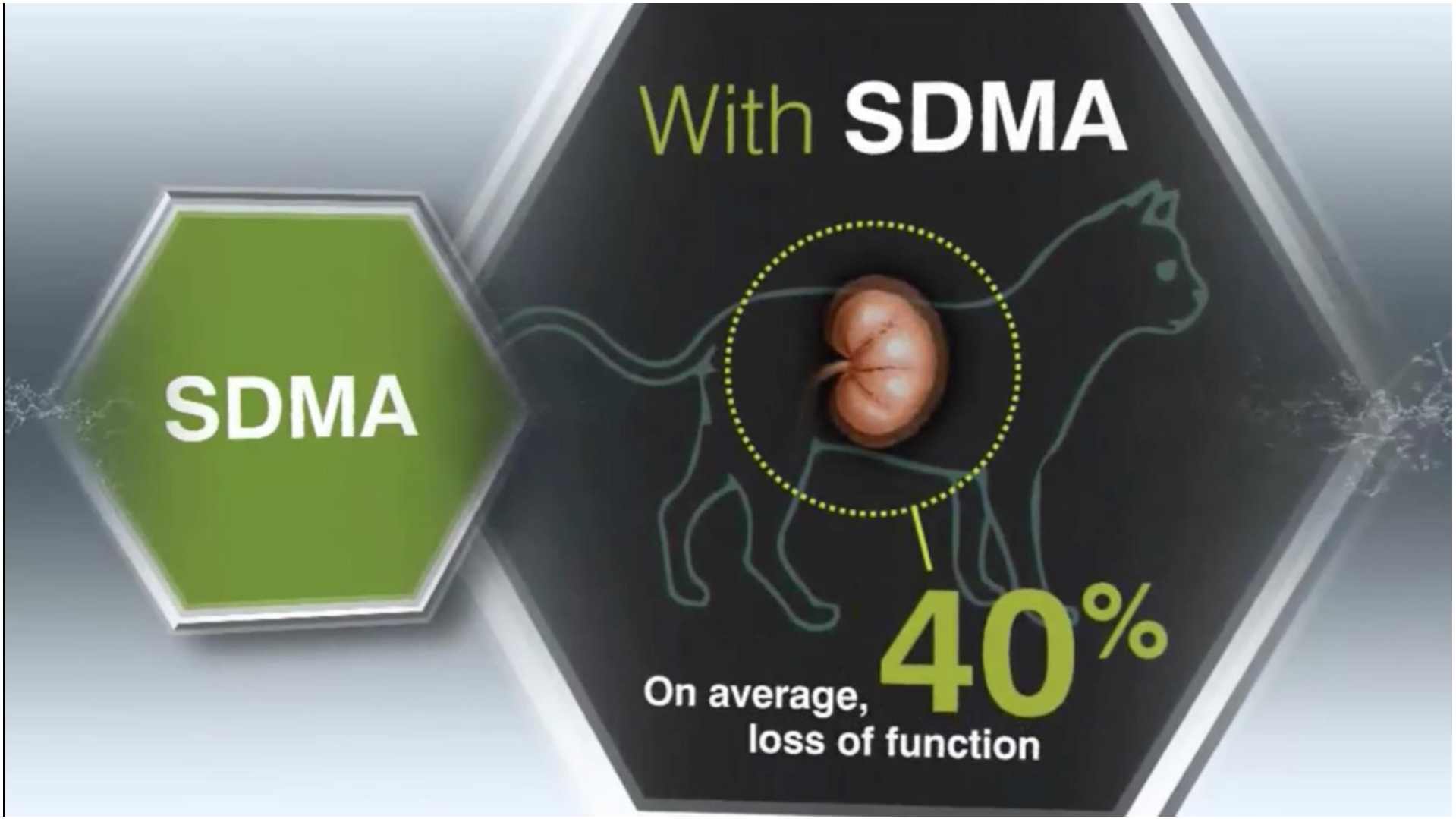

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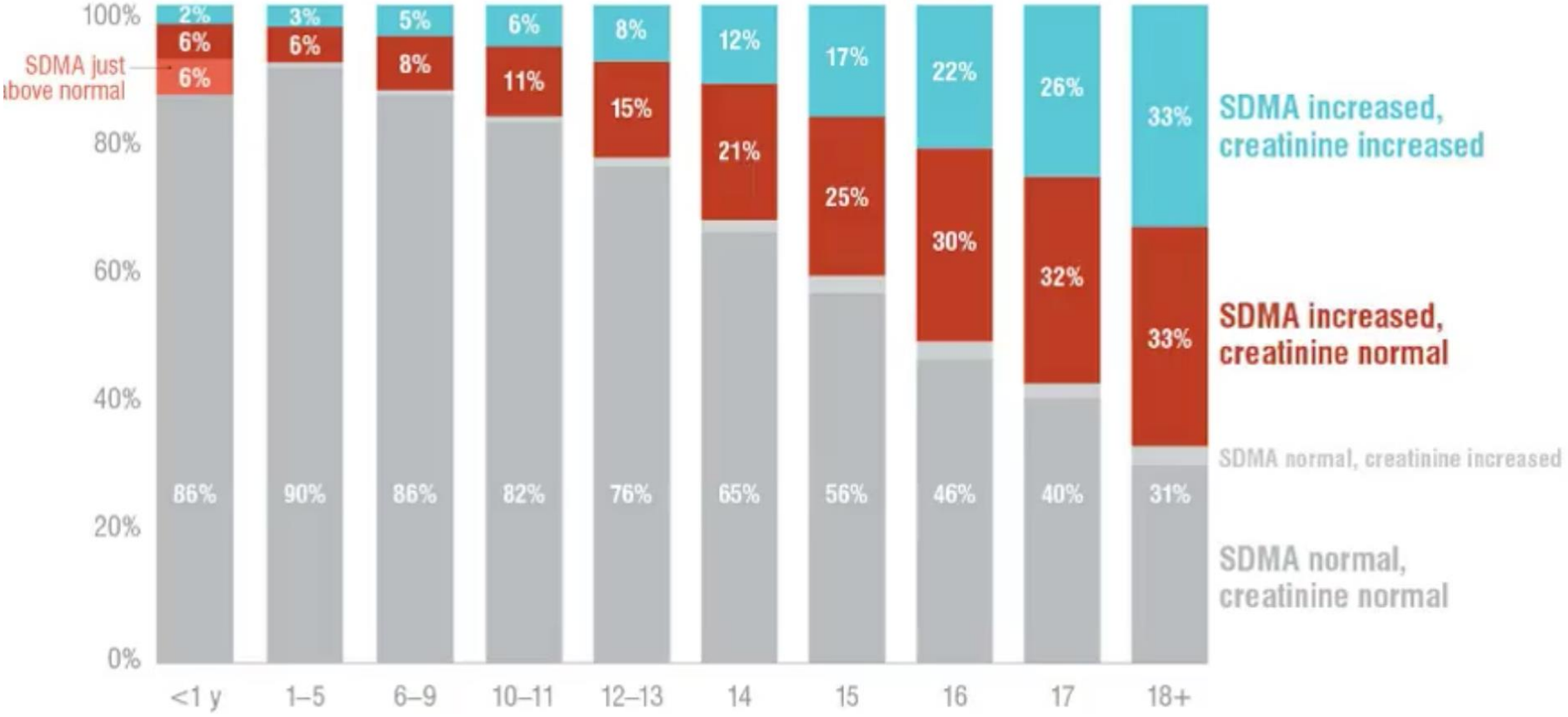
貓咪有SDMA之後



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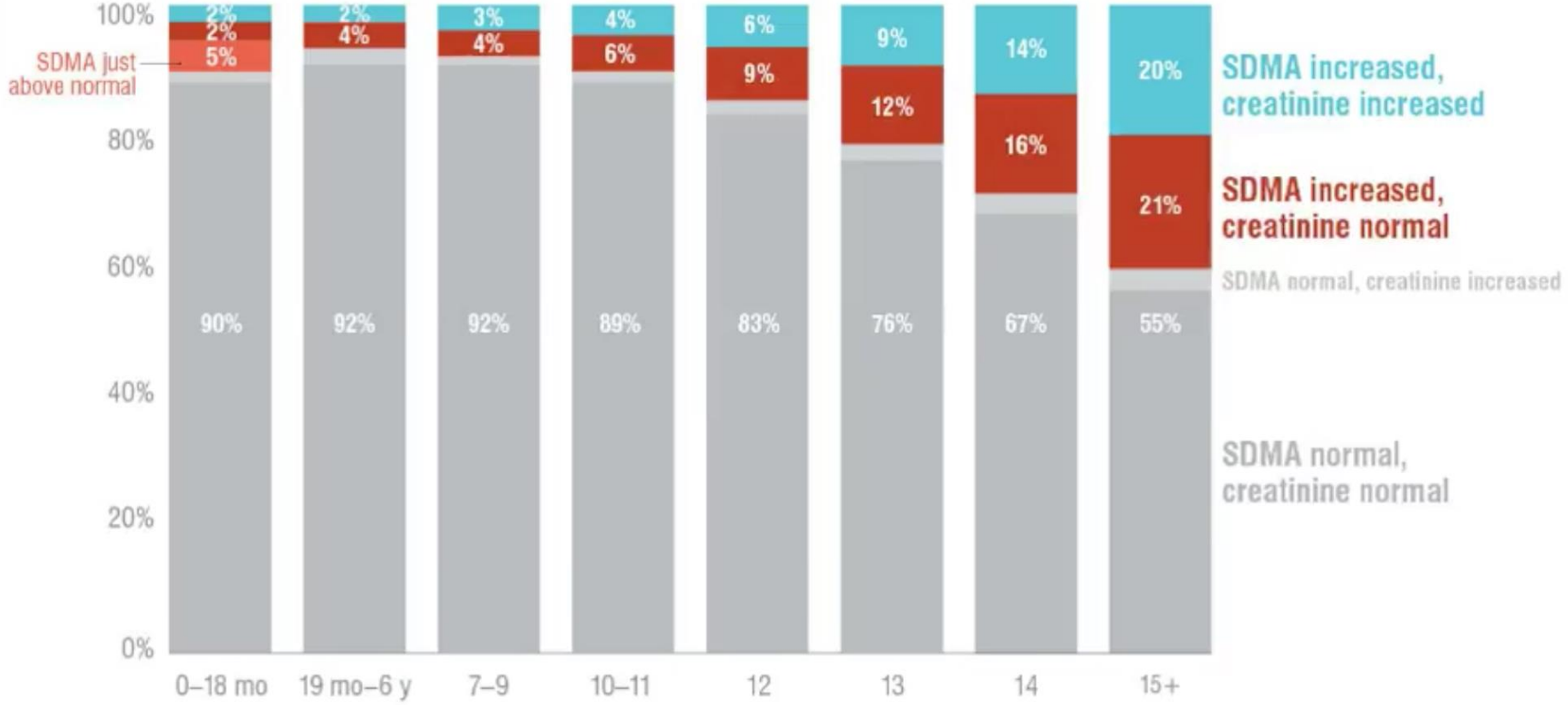
狗狗有SDMA之後



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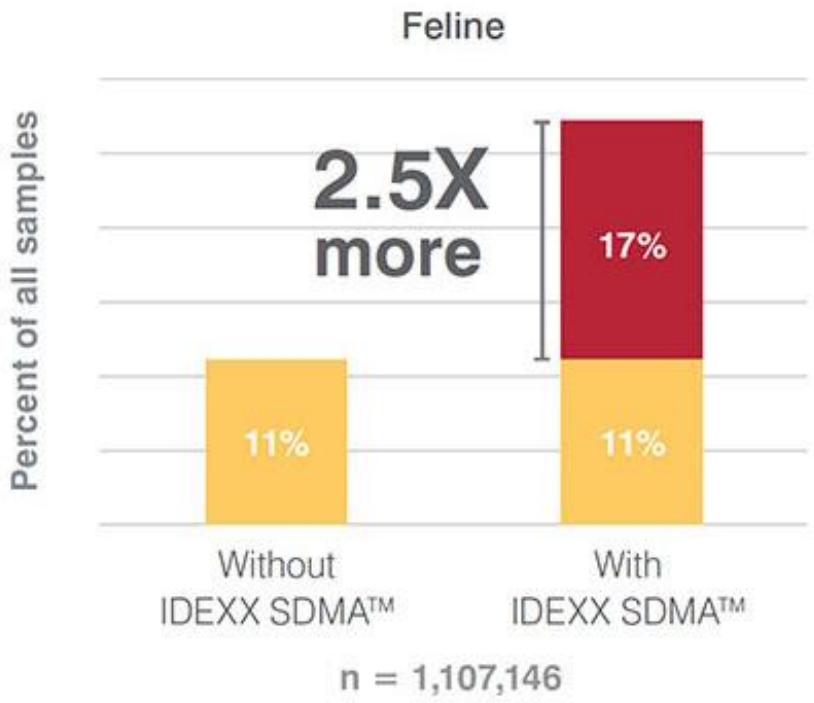
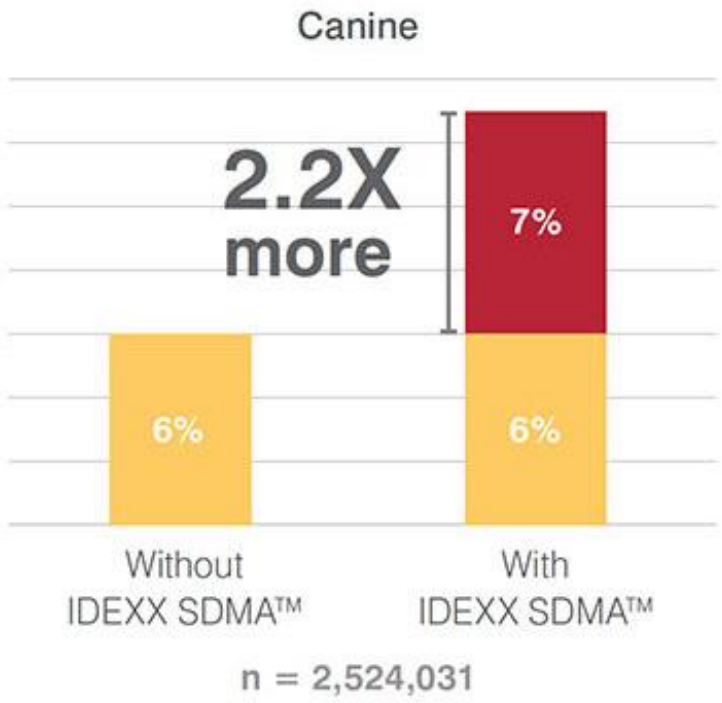
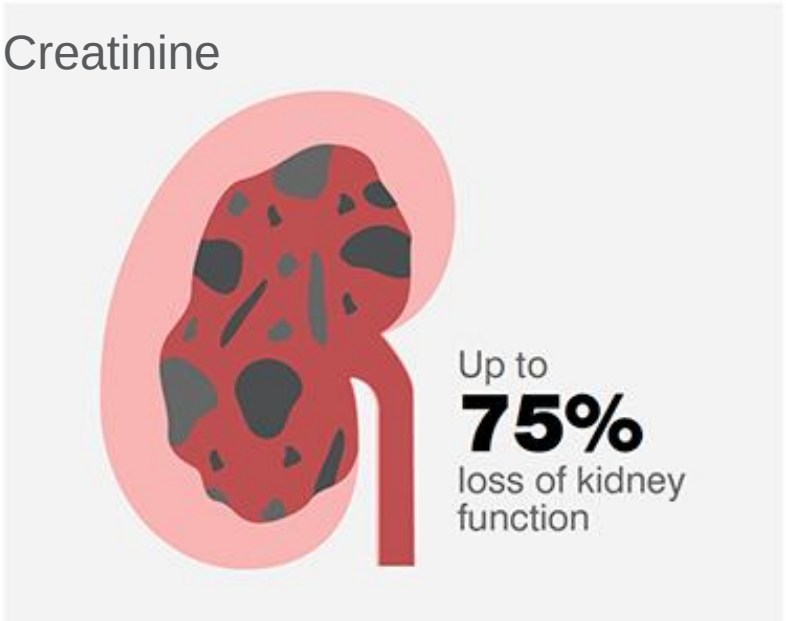
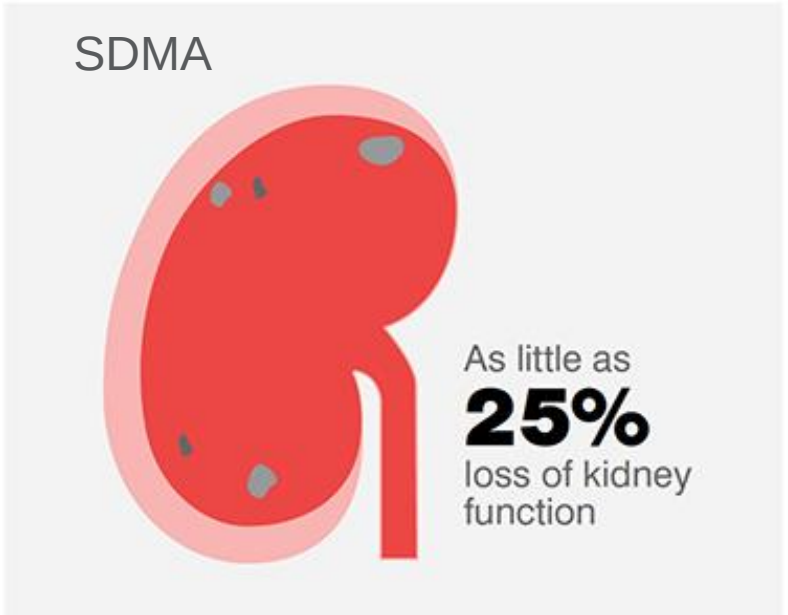

Feline
Percent of all samples
2.5X more
17%
11%
11%
Without IDEXX SDMA™
With IDEXX SDMA™
n = 1,107,146


Canine
2.2X more
7%
6%
6%
Without IDEXX SDMA™
With IDEXX SDMA™
n = 2,524,031


Creatinine
Up to
75%
loss of kidney function


SDMA
As little as
25%
loss of kidney function

Take Home Message

- 搭配Cre，SDMA在每種狀況下的應用
- 完整腎臟的評估，尿液學檢查扮演極重要的角色
- 禁食後的Cre!!
- 謹慎的診斷腎臟疾病！

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