網網網織球怎麼那麼高? 血小板又紅字了!
臨床上如何面對這些高高低低的指數?

林辰柔 、張璨文 獸醫師 | Mar 22 2022

血液學系列回顧

- Nov 4 2020 – 張璨文 ProCyte Dx 點狀圖。**再生性貧血**的病因調查
  - 貧血病因的調查與追蹤---網織球的臨床運用分享

- Feb 22 2021- 張璨文 ProCyte Dx 點狀圖。**非再生性貧血**的病因調查
  - 網織球之臨床運用2: 常見非再生性貧血之臨床診斷

- Apr 26 2021 - Seigo Ogasawara ProCyte Dx 點狀圖。**犬貓**的判讀比較
  - 從血球點狀圖看世界- 犬貓的血球比較與炎症和腫瘤臨床案例

- Sep 14 2021 - Dennis B. DeNicola ProCyte One 點狀圖。**網織球**的評估
  - 新時代的血液學分析介紹 及網織球的臨床應用的過去與現之探討
  - Introducing the new hematology analyzer, and discussion on the utility of reticulocyte assessment in today's practice

今天的重點

- 四隻貴賓狗的故事..
- 網織球增多的意義
- 血小板指數的判讀與臨床意義

#1 胖胖 的故事

胖胖

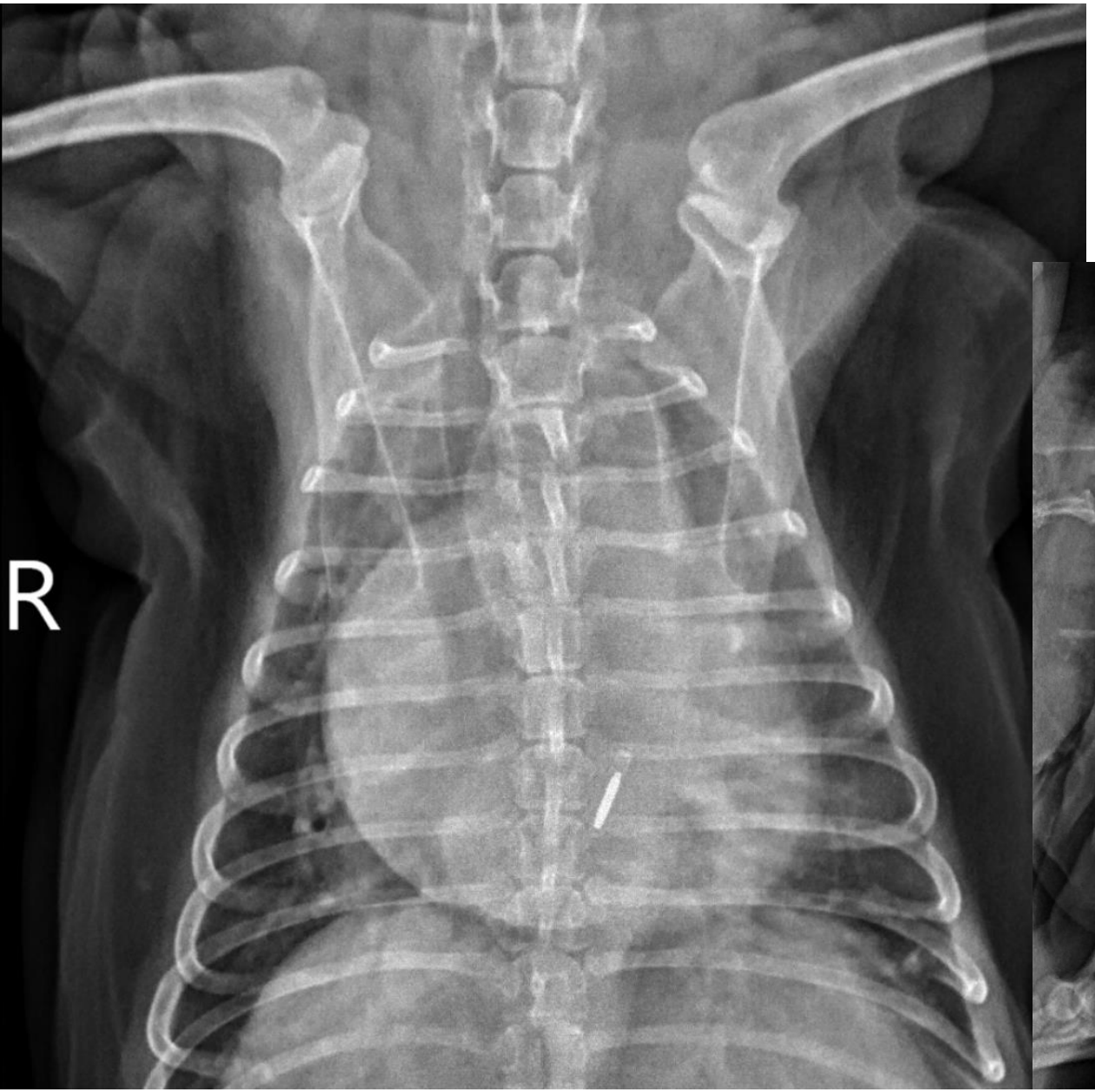
- 12y/o MN poodle
- 4kg BCS:8/9, blue MM,

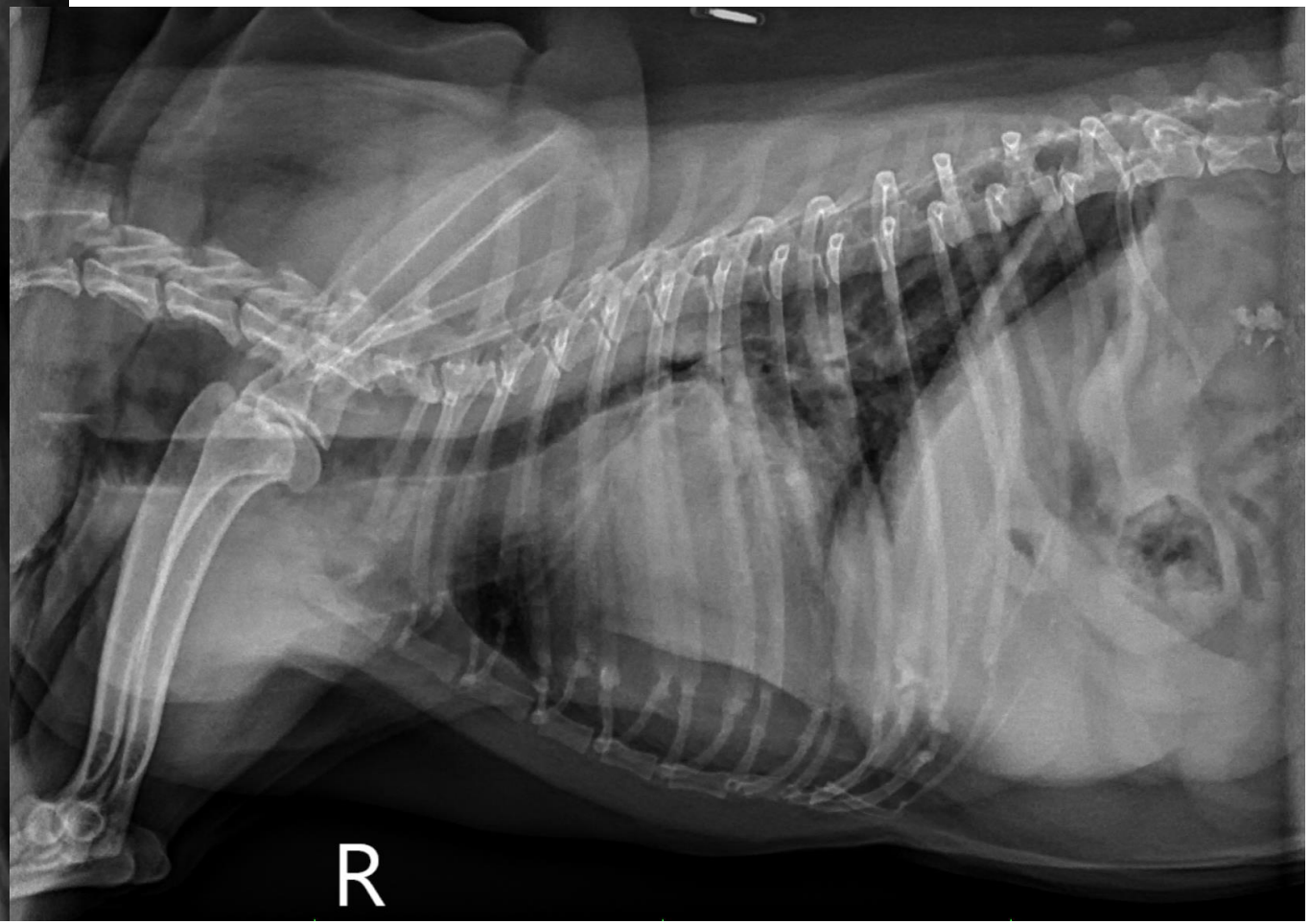
- 因急性喘，呼吸急促就診

- 心臟超音波：MMVD stage C (MR, TR)
- 輕微肺水腫

- 緊張激動
- 152/107/96 (170)

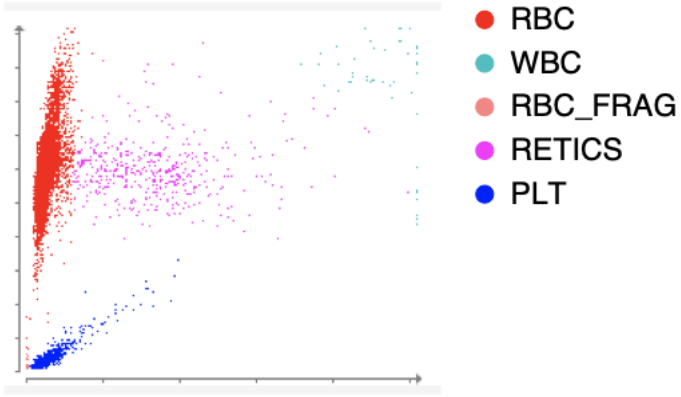
Pimobendan
Furosemide
Amlodipine



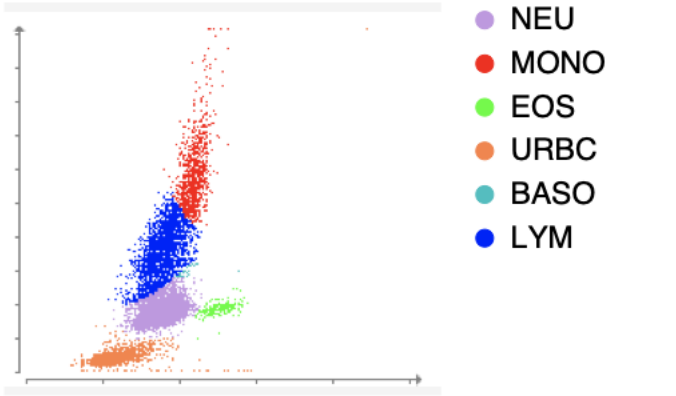


2021/12/20

TEST	RESULT	REFERENCE VALUE	
RBC	7.91	5.65 - 8.87 M/µL	
Hematocrit	54.2	37.3 - 61.7 %	
Hemoglobin	17.9	13.1 - 20.5 g/dL	
MCV	68.5	61.6 - 73.5 fL	
MCH	22.6	21.2 - 25.9 pg	
MCHC	33.0	32.0 - 37.9 g/dL	
RDW	19.1	13.6 - 21.7 %	
% Reticulocyte	2.2	%	
Reticulocytes	**174.8**	**10.0 - 110.0 K/µL**	H
Reticulocyte Hemoglobin	25.1	22.3 - 29.6 pg	
WBC	14.23	5.05 - 16.76 K/µL	
% Neutrophils	68.4	%	
% Lymphocytes	20.9	%	
% Monocytes	8.6	%	
% Eosinophils	1.8	%	
% Basophils	0.3	%	
Neutrophils	9.74	2.95 - 11.64 K/µL	
Lymphocytes	2.97	1.05 - 5.10 K/µL	
Monocytes	**1.22**	**0.16 - 1.12 K/µL**	H
Eosinophils	0.26	0.06 - 1.23 K/µL	
Basophils	0.04	0.00 - 0.10 K/µL	
Platelets	437	148 - 484 K/µL	
PDW	14.9	9.1 - 19.4 fL	



Download



Chemistry

12/20/21	12:27 PM	10:52 AM

TEST	RESULT	REFERENCE VALUE	
Glucose	136	70 - 143 mg/dL	
IDEXX SDMA [c]	**16**	**0 - 14 µg/dL**	H
Creatinine	0.7	0.5 - 1.8 mg/dL	
BUN	7	7 - 27 mg/dL	
BUN: Creatinine Ratio	9		
Phosphorus	3.3	2.5 - 6.8 mg/dL	
Calcium	10.4	7.9 - 12.0 mg/dL	
Sodium	152	144 - 160 mmol/L	
Potassium	4.2	3.5 - 5.8 mmol/L	
Na: K Ratio	37		
Chloride	118	109 - 122 mmol/L	
Total Protein	7.2	5.2 - 8.2 g/dL	

TEST	RESULT	REFERENCE VALUE	
Albumin	3.4	2.2 - 3.9 g/dL	
Globulin	3.8	2.5 - 4.5 g/dL	
Albumin: Globulin Ratio	0.9		
ALT	117	10 - 125 U/L	
ALP	**539**	**23 - 212 U/L**	H
GGT	7	0 - 11 U/L	
Bilirubin - Total	0.2	0.0 - 0.9 mg/dL	
Cholesterol	149	110 - 320 mg/dL	
Osmolality	301	mmol/kg	

Endocrinology

Click to view Differentials

12/20/21
10:52 AM

Total T4	[a] 1.3	1.0 - 4.0 µg/dL	

[a] 總甲狀腺素（TT4）的診斷解讀
< 1.0 µg/dL 低
1.0 - 2.0 µg/dL 正常偏低
1.0 - 4.0 µg/dL 正常
> 4.0 µg/dL 高
2.1 - 5.4 µg/dL 治療
無甲狀腺機能低下臨床症狀且結果落在正常參考值之內的狗，可能患有甲狀腺正常症。 甲狀腺素（T4）濃度低的狗，可能患有甲狀腺機能低下或「甲狀腺正常症」。 偶而狀況下，甲狀腺機能低下的狗，甲狀腺素（T4）濃度會是正常偏低。 具有甲狀腺機能低下臨床症狀且甲狀腺素（T4）濃度為低或正常偏低的狗，可外送檢體進行游離甲狀腺素（fT4）和犬 TSH 檢測，以進一步評估。 臨床上正常的狗若甲狀腺素（T4）濃度為高，可能是正常的變化；但濃度的升高也可能繼發於甲狀腺自體抗體或罕見的甲狀腺腫瘤之後。 對於使用甲狀腺補充劑的狗，服藥後 4-6 小時可接受的總甲狀腺素（T4）濃度一般會落於參考範圍的高點或略高於上限。

Serology

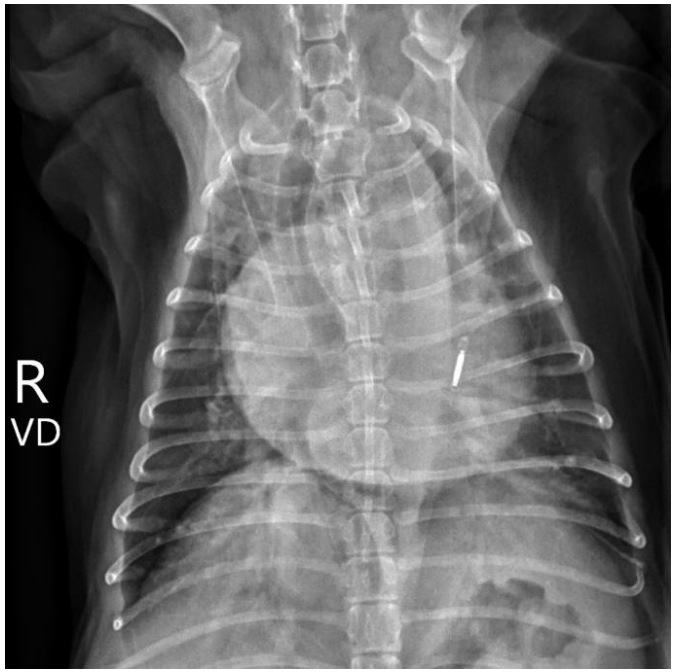
Click to view Differentials

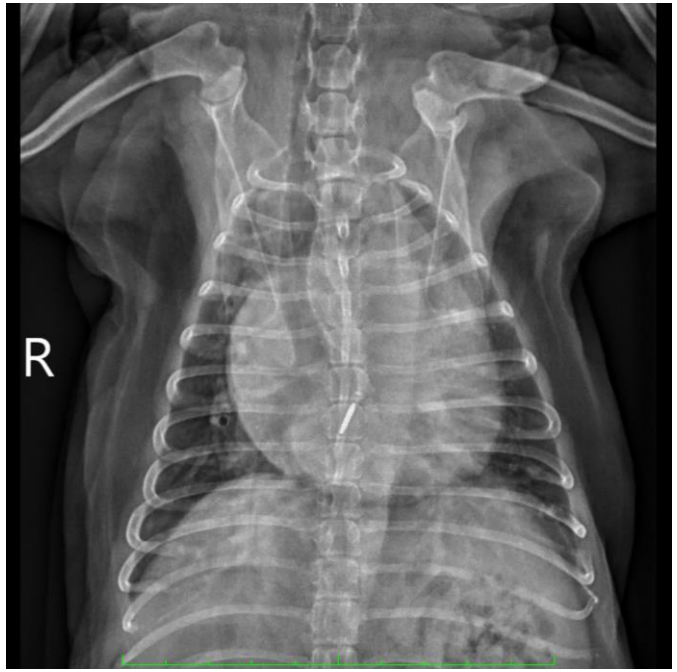
12/20/21
11:54 AM

Heartworm Antigen	Negative
Ehrlichia canis / ewingii	Negative
Lyme (Borrelia burgdorferi)	Negative
Anaplasma phagocytophilum / platys	Negative

- 回診 狀況穩定
- 呼吸活力 腎指數穩定
- 持續用藥

- 一個月後突然急性呼吸困難
- 診斷為肺水腫 合併肺炎？





Hematology

Click to view Differentials

	3/7/22 2:51 PM	3/3/22 5:11 PM	3/2/22 11:12 AM	2/25/22 3:06 PM	2/25/22 3:00 PM	2/11/22 3:47 PM	1/28/22 2:55 PM
RBC	7.39	7.73	7.81	8.15	8.12	8.07	8.11
Hematocrit	49.6	51.5	53.6	55.9	53.8	56.2	52.3
Hemoglobin	16.6	17.4	17.6	18.6	18.5	18.1	19.2
MCV	67.1	66.6	68.6	68.6	66.3	69.6	64.4
MCH	22.5	22.5	22.5	22.8	22.8	22.4	23.7
MCHC	33.5	33.8	32.8	33.3	34.3	32.2	36.8
RDW	19.1	19.6	18.9	19.4	21.0	18.7	21.2
% Reticulocyte	2.8	2.5	2.0	2.1	1.8	1.6	1.6
Reticulocytes	**206.2**	**194.0**	**156.2**	**171.2**	**149.6**	**130.7**	**127.7**
Reticulocyte Hemoglobin	23.2	25.5	25.5	23.6		23.4	
WBC	**20.06**	**18.66**	**17.79**	**18.85**	**19.47**	13.21	14.33
% Neutrophils	73.7	70.3	69.9	69.9	67.4	74.2	65.3
% Lymphocytes	15.7	19.6	19.6	18.7	17.3	16.0	20.8
% Monocytes	10.0	9.1	9.5	9.1	14.5	7.0	13.5

Endocrinology

	3/3/22 4:58 PM	3:55 PM
Cortisol - Baseline	2.9	µg/dL
Cortisol Post-ACTH (Cushings selected)	16.5	µg/dL

ACTH 刺激試驗 (庫興氏症候群篩檢)
< 2 µg/dL - 若有臨床症狀支持，結果與艾迪生氏症 (Addison's Disease) 相符
2 - 6 µg/dL - 不確定
6 - 18 µg/dL - 正常
18 - 22 µg/dL - 可能為庫興氏症候群 (Cushing's Syndrome)
> 22 µg/dL - 若有臨床症狀支持，結果與庫興氏症候群 (Cushing's Syndrome) 相符

愛德士公司提供的臨床診斷是參照內科醫學文獻及獸醫建立的參考值為基準。 任何建議都不能直接做為臨床判讀的依據。

Immunology

Click to view Differentials

	3/11/22 3:39 PM	3/2/22 11:48 AM	2/27/22 11:27 AM	2/25/22 3:14 PM
C-Reactive Protein (CRP)	a 0.8	b 0.6	c 0.3	d 0.9

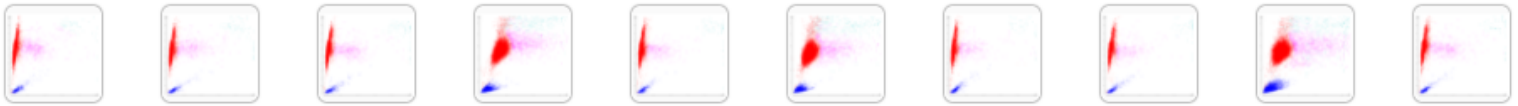
胖胖

- 心臟狀況不理想
- 性格緊張，無法住院
- 合併肺炎感染？
- 其他問題？？
- 控制不良
- 呼吸狀況越來越不理想

- 安樂

Hematology

Click to view Differentials

	3/3/22 5:11 PM	3/2/22 11:12 AM	2/25/22 3:06 PM	2/25/22 3:00 PM	2/11/22 3:47 PM	1/28/22 2:55 PM	1/22/22 2:18 PM	1/19/22 10:15 AM	12/20/21 1:19 PM	12/20/21 10:36 AM
RBC	7.73	7.81	8.15	8.12	8.07	8.11	7.84	7.35	8.07	7.91
Hematocrit	51.5	53.6	55.9	53.8	56.2	52.3	54.2	48.6	52.6	54.2
Hemoglobin	17.4	17.6	18.6	18.5	18.1	19.2	18.4	16.7	19.7	17.9
MCV	66.6	68.6	68.6	66.3	69.6	64.4	69.1	66.1	65.2	68.5
MCH	22.5	22.5	22.8	22.8	22.4	23.7	23.5	22.7	24.4	22.6
MCHC	33.8	32.8	33.3	34.3	32.2	36.8	33.9	34.4	37.5	33.0
RDW	19.6	18.9	19.4	21.0	18.7	21.2	18.9	18.1	21.7	19.1
% Reticulocyte	2.5	2.0	2.1	1.8	1.6	1.6	1.4	1.5	2.4	2.2
Reticulocytes	**194.0**	**156.2**	**171.2**	**149.6**	**130.7**	**127.7**	**112.9**	108.8	**194.5**	**174.8**
Reticulocyte Hemoglobin	25.5	25.5	23.6		23.4		24.8	23.2		25.1
WBC	**18.66**	**17.79**	**18.85**	**19.47**	13.21	14.33	12.85	13.29	16.02	14.23
% Neutrophils	70.3	69.9	69.9	67.4			2	70.7	68.6	68.4
% Lymphocytes	19.6	19.6	18.7	17.3			3	17.8	18.2	20.9
% Monocytes	9.1	9.5	9.1	14.5				9.7	12.8	8.6
% Eosinophils	0.9	1.0	1.6	0.7		0.2	1.9	1.6	0.2	1.8
% Basophils	0.1	0.0	0.7	0.1	0.6	0.2	0.3	0.2	0.3	0.3
Neutrophils	**13.13**	**12.43**	**13.18**	**13.12**	9.81	9.36	9.02	9.40	10.99	9.74
Lymphocytes	3.65	3.49	3.52	3.38	2.11	2.98	2.35	2.36	2.91	2.97
Monocytes	**1.70**	**1.69**	**1.71**	**2.82**	0.92	**1.94**	**1.20**	**1.29**	**2.05**	**1.22**
Eosinophils	0.17	0.18	0.31	0.14	0.29	**0.03**	0.24	0.21	**0.03**	0.26
Basophils	0.01	0.00	**0.13**	0.02	0.08	0.03	0.04	0.03	0.04	0.04
Platelets	342	380	399	413	440	443	408	304	**627**	437
PDW	12.6	11.7	12.5	**8.5**	12.7	**7.5**	15.6	15.7	15.8	14.9
MPV	11.9	11.3	11.6	8.7	12.2	**7.7**	12.7	12.0	9.5	12.1
Plateletcrit	0.41	0.43	0.46	0.36	**0.54**	0.34	**0.52**	0.36	**0.60**	**0.53**
RBC Run										
WBC Run										

RBC 質量正常

RET 增加

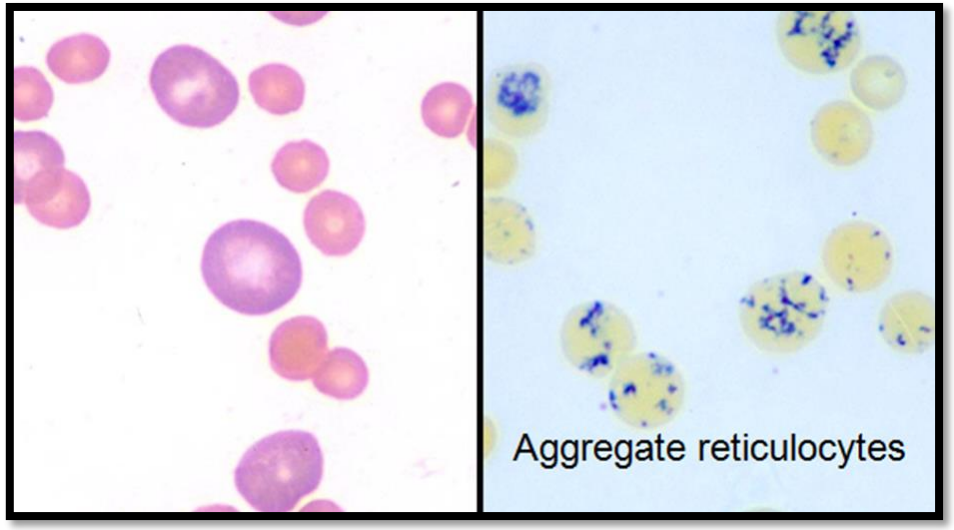
炎症白血球相

緊迫白血球相

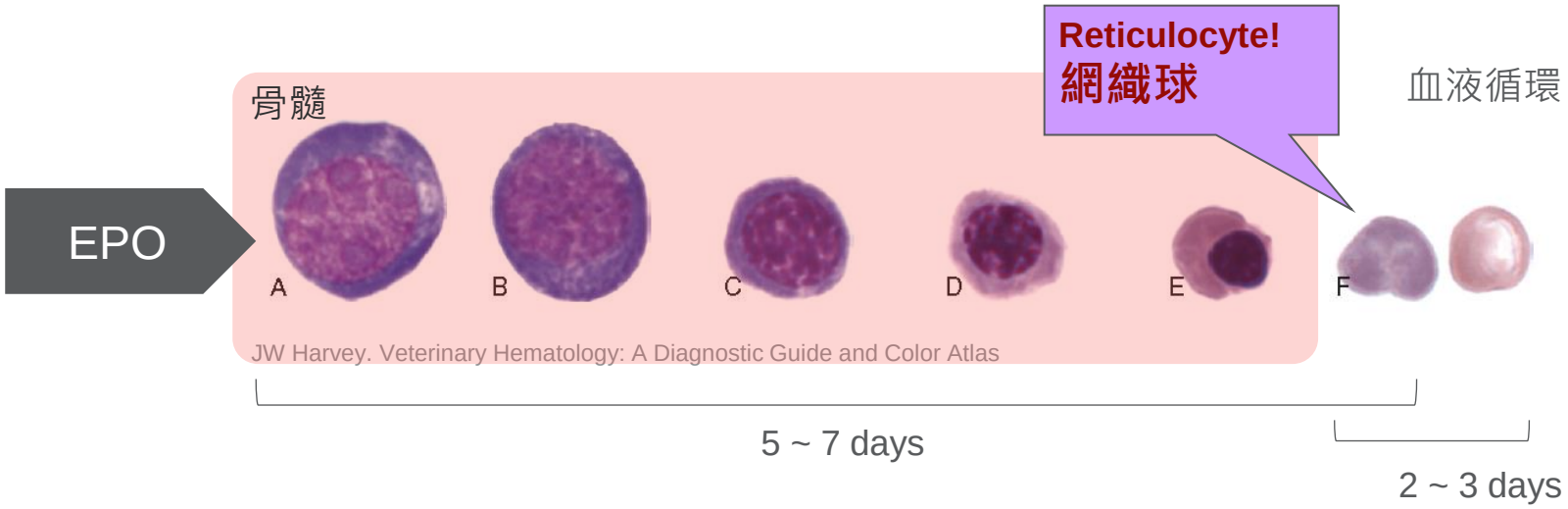
PLT 增加

IDEXX

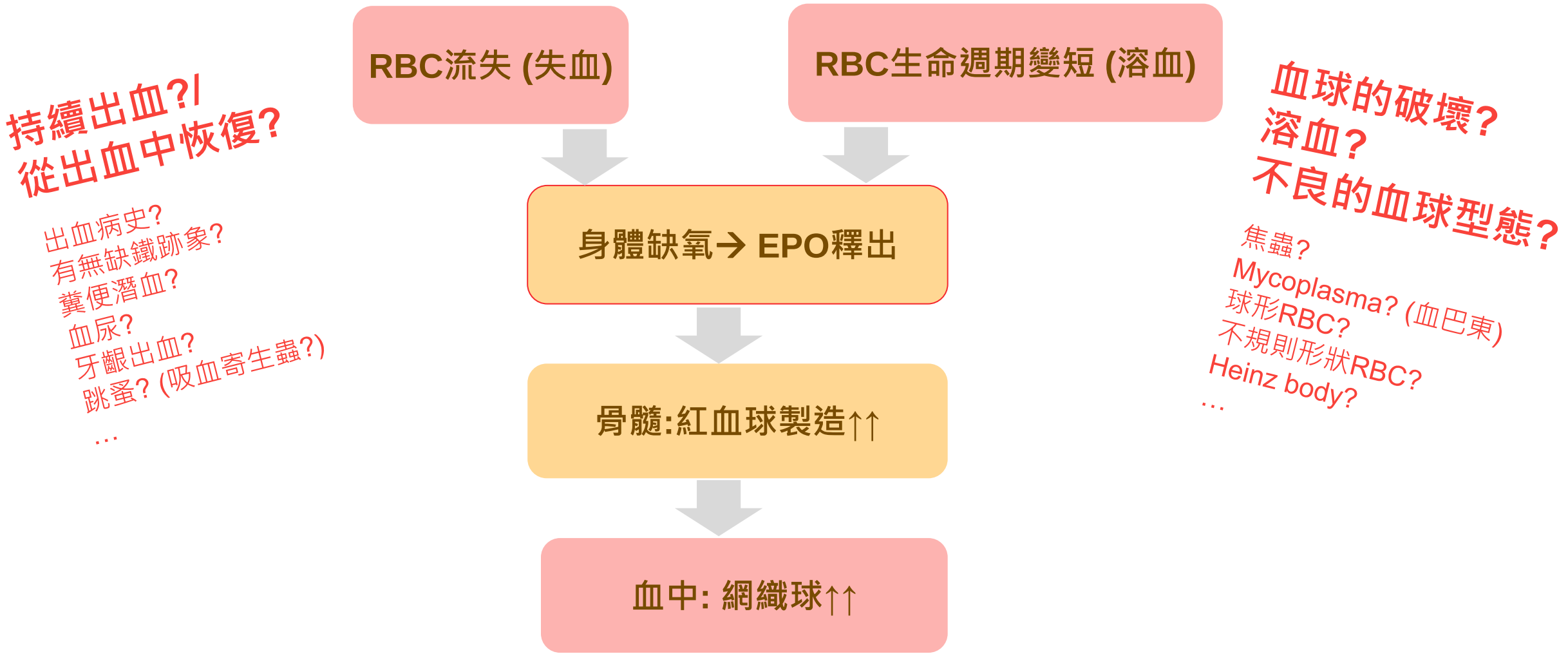
網織球的臨床意義



胖胖有持續的刺激使得RET不斷生成.....



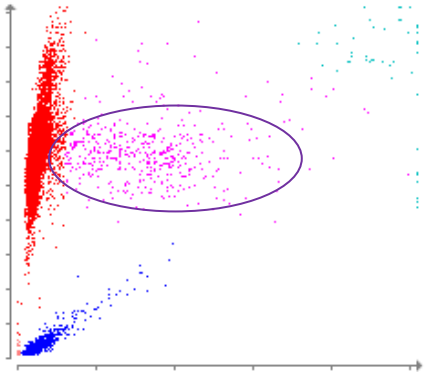
網織球升高的意涵?



從ProCyte Dx 點狀圖觀察 RET的分布

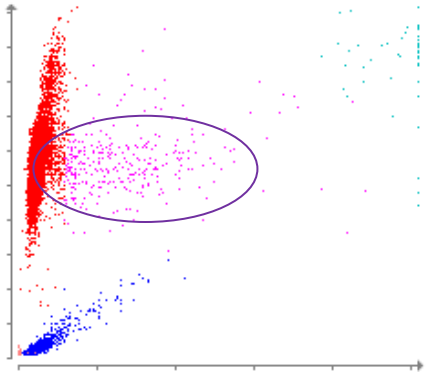
- ✓ 沒有鮮明的出血證據
- ✓ 沒有缺鐵的證據
- ✓ 沒有RBC碎片很多的證據

12/20/21



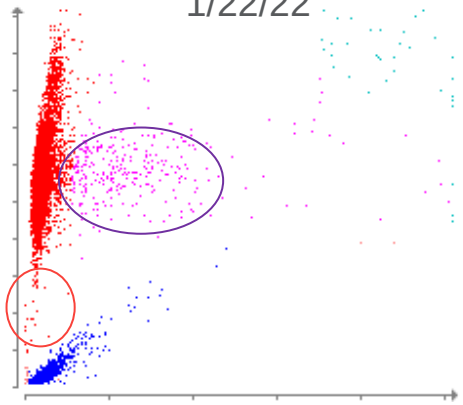
RET= 174.8K ↑

1/19/22



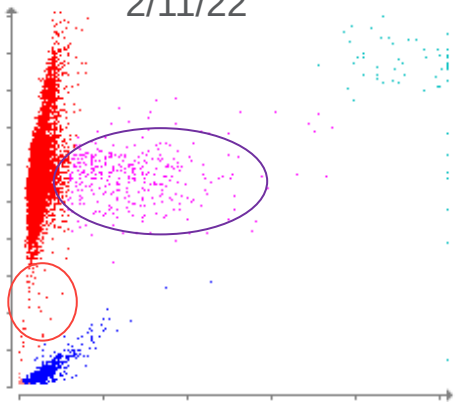
RET= 108.8K

1/22/22



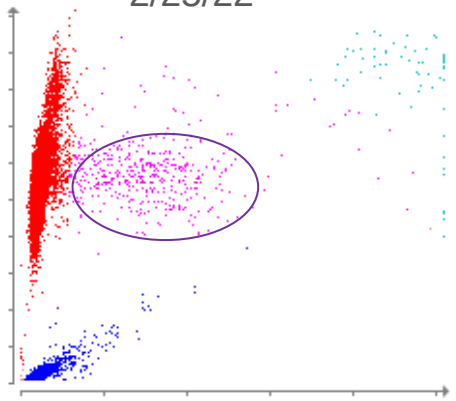
RET= 112.9K ↑

2/11/22



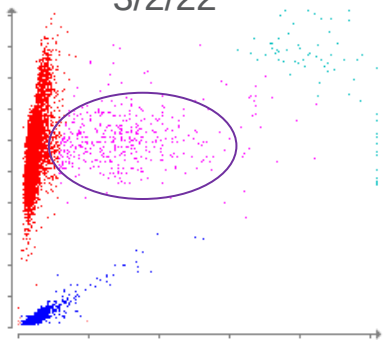
RET= 130.7K ↑

2/25/22



RET= 149.6K ↑

3/2/22



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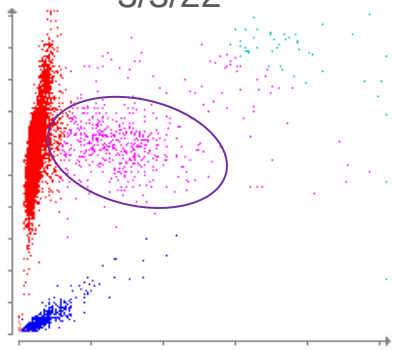
3/3/22



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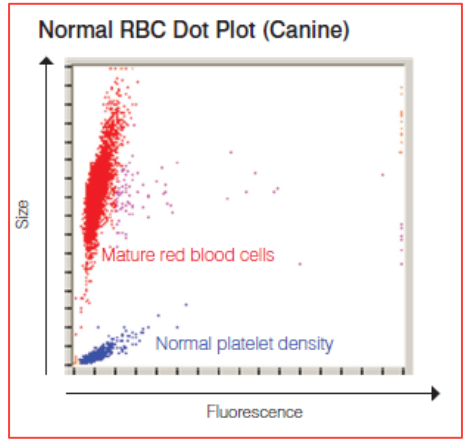
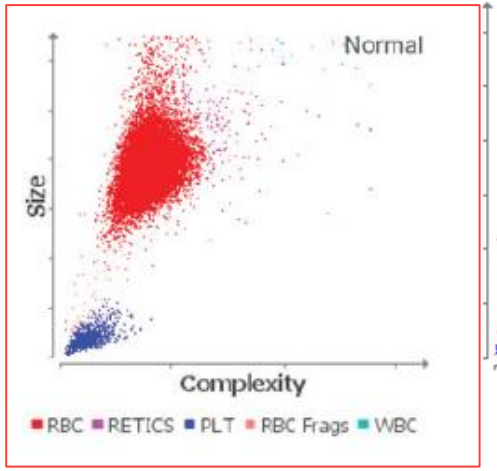


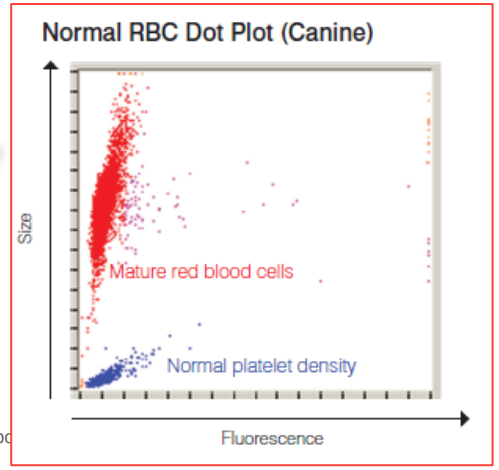
ProCyte One 也可以透過點狀圖觀察 RET 分布

ProCyte One

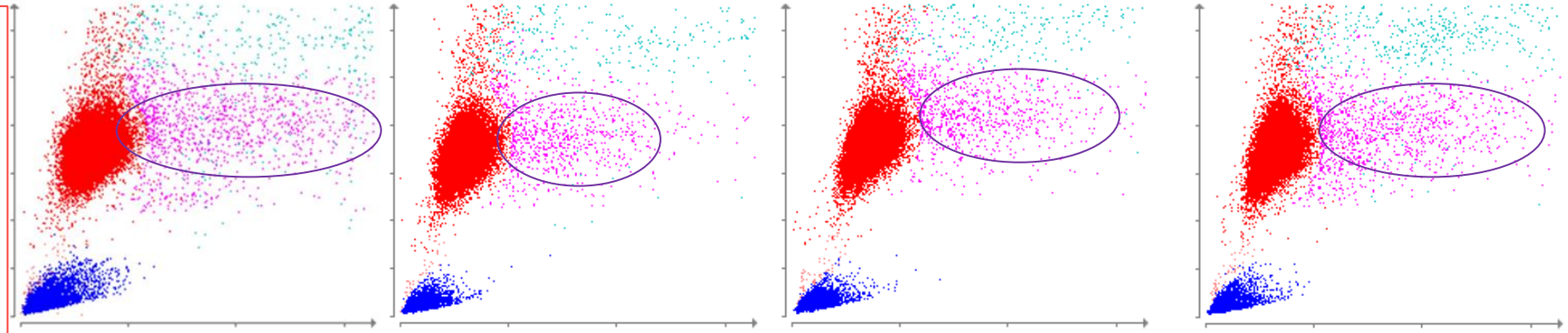
狗正常點狀圖



ProCyte Dx

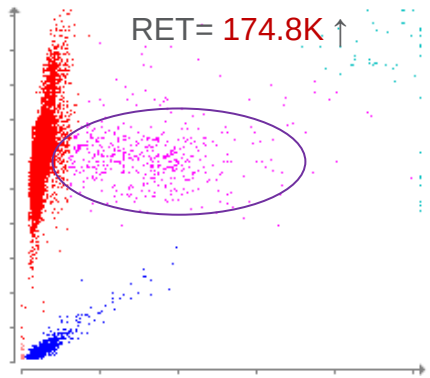


1/28/22



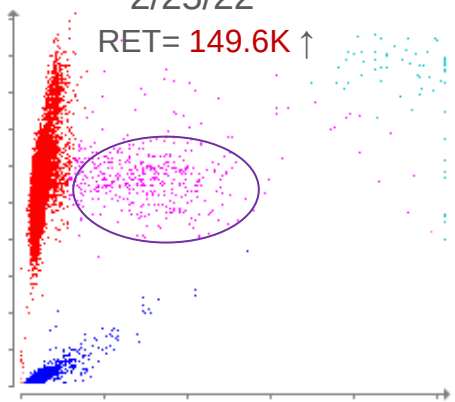
12/20/21

RET= 174.8K ↑



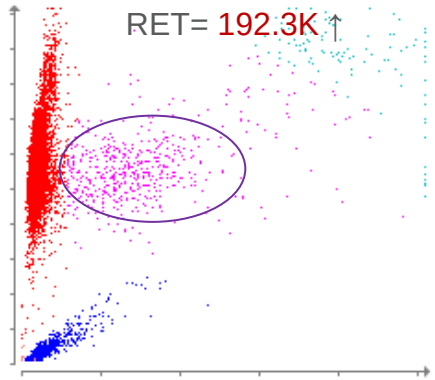
2/25/22

RET= 149.6K ↑



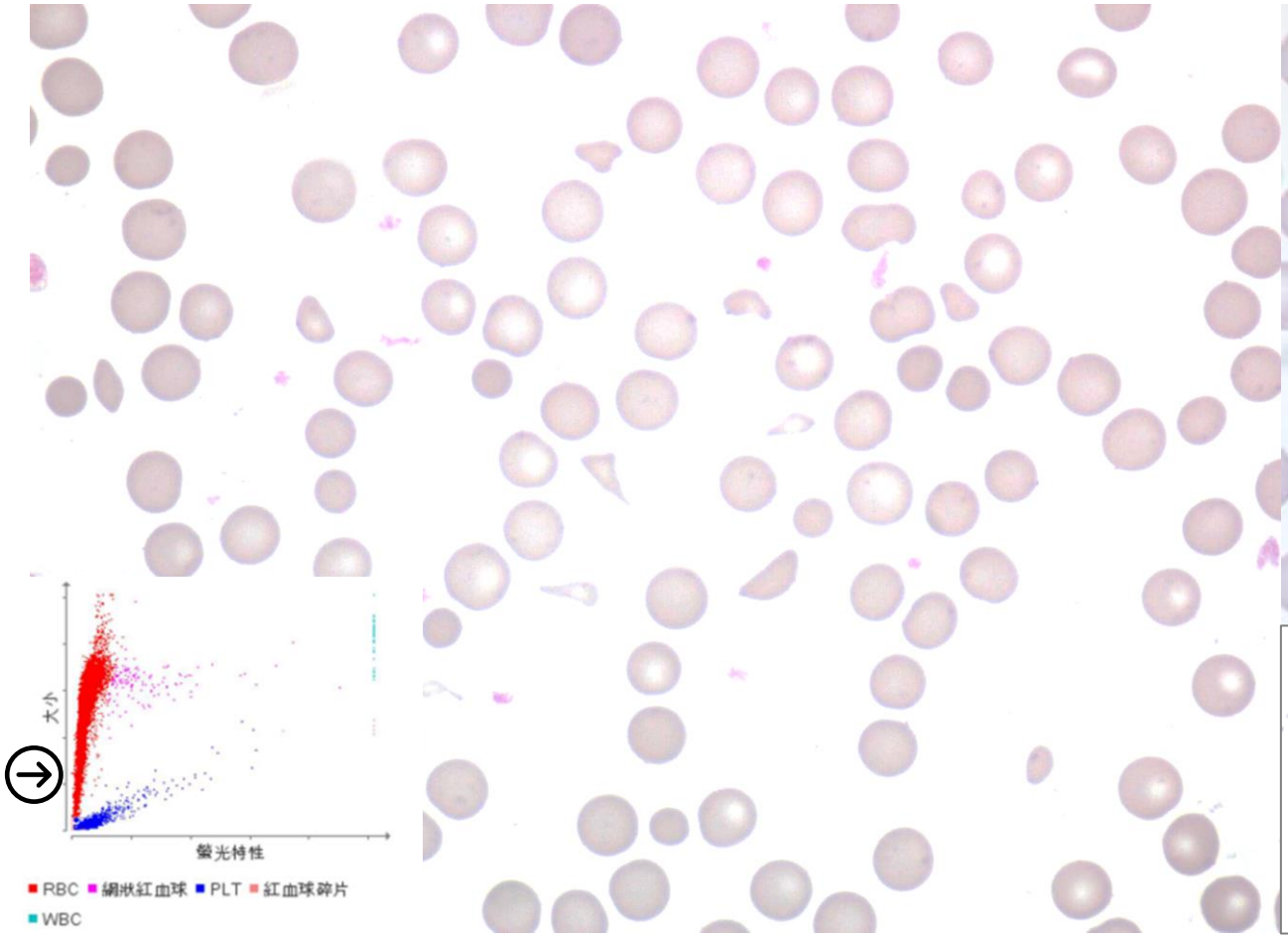
3/11/22

RET= 192.3K ↑

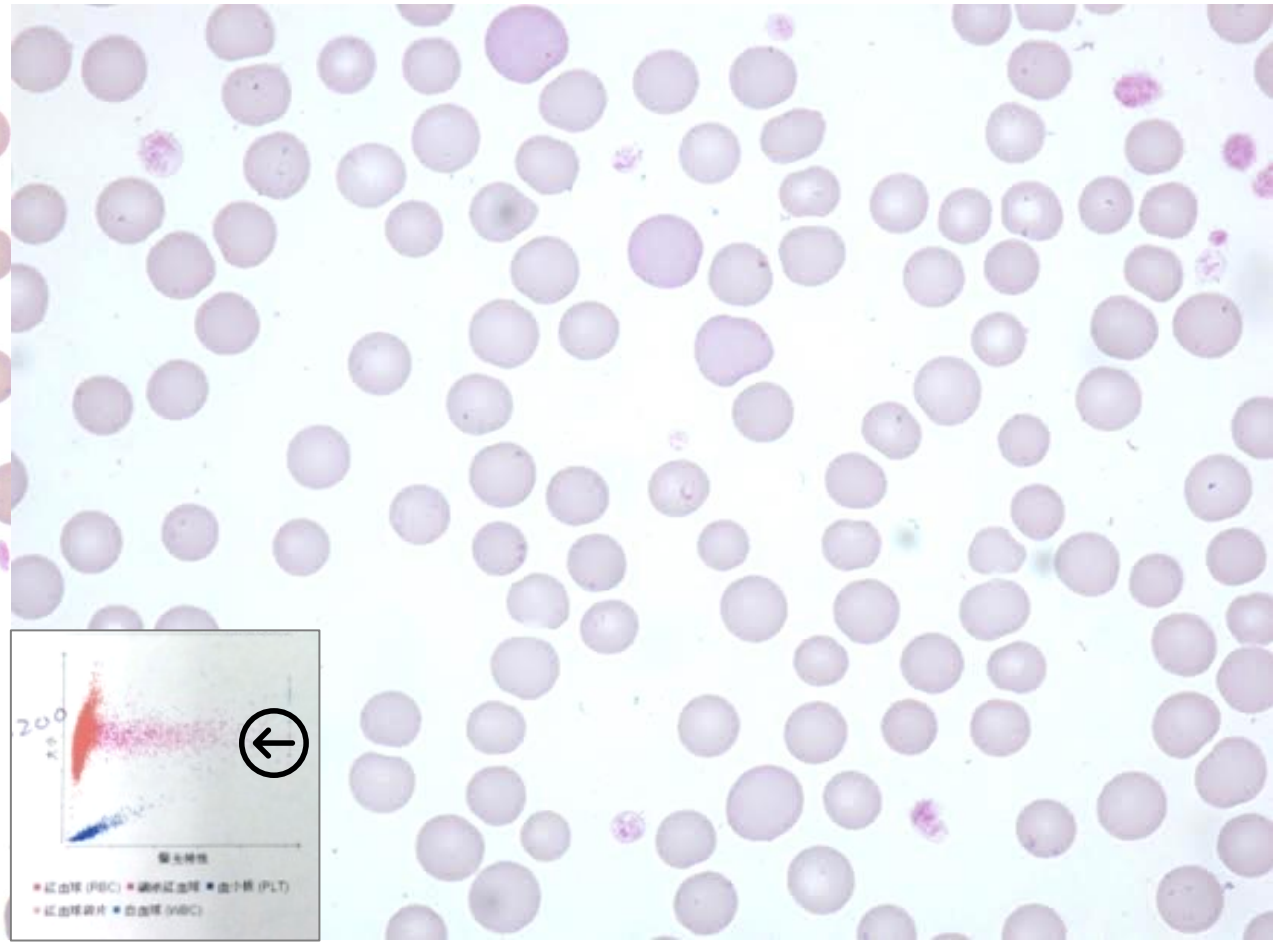


之前遇到的一些預料之外的RBC破壞，造成網織球增加

心臟病犬: 瓣膜問題造成RBC物理性破壞



焦蟲感染犬: 感染伴隨自體免疫造成RBC破壞



Veterinary Clinical Pathology ISSN 0275-6382

ORIGINAL RESEARCH

Reticulocytosis in nonanemic dogs: increasing prevalence and potential etiologies

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Key Words
Canine, erythropoiesis, iron deficiency, osteoarthritis, risk factors

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DOI:10.1111/vcp.12215

Background: An increasing prevalence of reticulocytosis in the absence of anemia (RAA) in dogs has been suspected in recent years.

Objectives: The objectives were to determine whether prevalence of RAA in our canine population has been increasing over the last years, and to identify potential predisposing factors.

Methods: The annual prevalence of RAA in adult dogs was determined between 2000 and 2012. Clinical histories and CBC data were analyzed for all dogs, as well as owner response to a questionnaire including information on nutrition and supplements was conducted for dogs with RAA identified between 2011 and 2012. In addition, serum iron concentration (Fe), total iron-binding capacity (TIBC), and percent transferrin saturation (%TS) were determined in 14 dogs with RAA and compared with 8 healthy control dogs.

Results: Reticulocytosis in the absence of anemia was identified in 1035 dogs, with the prevalence increasing since 2006. Dogs with RAA evaluated after 2006 (n = 853) had significantly lower MCV and were more likely to have microcytosis than those prior to 2006 (n = 182). Increased incidence of osteoarthritis was observed in dogs evaluated after 2006, including the dogs studied between 2011 and 2012 (n = 31), and administration of non-steroidal anti-inflammatory drugs, omega-3 fatty acids, and glucosamine was more common in the latter. Significantly lower mean Fe and %TS, and higher TIBC were found in dogs with RAA compared to unaffected dogs.

Conclusions: Prevalence of RAA has increased in recent years in our canine population. More ubiquitous use of anti-inflammatory medications and nutraceuticals, associated with increased diagnosis of osteoarthritis should be considered as contributing factors.

Pattullo et al. Vet Clin Pathol (2015):26–36

關於無貧血但網織球 增加的臨床調查

- RAA= Reticulocytosis in the Absence of Anemia
- 加拿大某 診斷實驗室 (2000-2012)
- 網織球人工計數

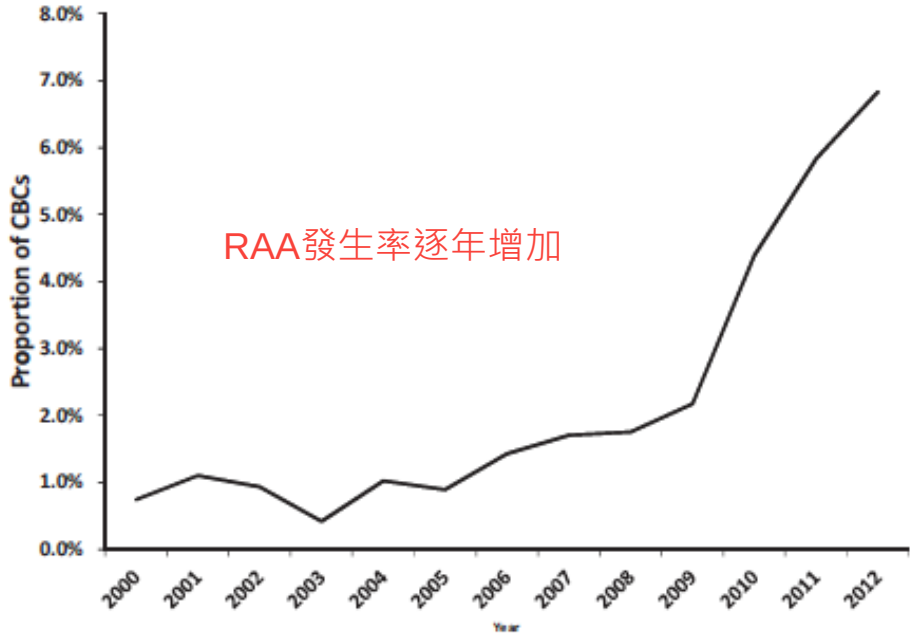

Figure 1. Prevalence of dogs ≥ 1 year of age with reticulocytosis (> 2.5%) in the absence of anemia (HCT > 0.45 L/L) in a general retrospective study based on samples submitted to Prairie Diagnostics Services (Saskatoon, SK) for CBC analysis between 2000 and 2012 (n = 1035).

17種臨床狀況的分類 與不同年份的比較

Table 2. Categorization of clinical diseases and conditions documented in dogs with reticulocytosis (> 2.5%) in the absence of anemia (HCT > 45%) analyzed at Prairie Diagnostic Services (Saskatoon, SK).

Category	Included Diseases and Conditions
Cardiovascular and respiratory diseases	Arrhythmia, aspiration pneumonia, collapsing trachea, congestive heart failure, dyspnea, hemothorax, laryngeal paralysis, pneumothorax, syncope
Dermatologic conditions	Allergies, atopy, otitis externa, pruritis
Endocrine diseases	Diabetes mellitus, hyperadrenocorticism, hypoadrenocorticism, hypothyroidism
Eosinophilia and basophilia	Eosinophil and/or basophil count above upper reference limit
Gastrointestinal and pancreatic diseases	Constipation, enterocolitis, foreign body, inflammatory bowel disease, pancreatitis, protein-losing enteropathies, regurgitation, vomiting, and diarrhea
Immune-mediated diseases	Immune-mediated hemolytic anemia, immune-mediated thrombocytopenia
Immunosuppressive drugs	Corticosteroids (percorten, prednisolone, prednisone), cyclosporine A, azathioprine
Inflammatory conditions	Evidence of inflammation on CBC, anal gland sacculitis, dermal necrosis and wounds, peritonitis, pneumonia (blastomycosis, *Pasteurella multocida*, *Pneumocystis* spp.), prostatitis, pyometra, upper respiratory infections, urinary tract infections, vaginitis
Liver-associated abnormalities	Elevated activities of ALP, ALT, GGT, and/or GLDH (at least 2 times upper reference limit); hyperbilirubinemia (at least 2 times upper reference limit)
Neoplasia	Carcinoma (anal sac adenocarcinoma, hepatocellular carcinoma, hepatoid gland adenocarcinoma, mammary carcinoma, nasal adenocarcinoma, pulmonary carcinoma, rectal carcinoma, squamous cell carcinoma, thyroid carcinoma, transitional cell carcinoma), insulinoma, malignant melanoma, round cell tumors (lymphoma, mast cell tumor), spindle cell tumors (hemangiosarcoma, soft tissue sarcoma)
NSAID	Aspirin, carprofen, deracoxib, diclofinac, ibuprofen, ketoprofen, meloxicam, peroxicam
Nutraceuticals	Glucosamine, *n*-3 polyunsaturated fatty acids (fish oil, flaxseed, flaxseed oil), zinc (oral rinses and water additives, zinc-based ointments), sodium pentosan polysulfate
Ophthalmologic diseases	Anterior uveitis, cataracts, episcleritis, keratoconjunctivitis sicca, nodular granular episcleritis, retinal detachment
Orthopedic diseases	Chronic pain, cranial cruciate ligament ruptures, fractures and dislocations, intervertebral disk disease, osteoarthritis
Overt blood loss and anemia recovery	Epistaxis, hematemesis, hematochezia, hematuria, melena, recent surgery, recovery from pancytopenia and immune-mediated hemolytic anemia
Recent seizures	Cluster seizures, recent seizure activity, status epilepticus
Renal diseases	Chronic renal failure, proteinuria

NSAID indicates non-steroidal anti-inflammatory drugs.

Table 3. Prevalence of potential predisposing factors in dogs with reticulocytosis (> 2.5%) in the absence of anemia (HCT > 0.45 L/L) from dogs analyzed in a general retrospective study (group A, 2000–2005, n = 182, and group B, 2006–2012, n = 853), and a detailed clinical study (group C, n = 100).

Conditions	A (%)	B (%)	C (%)
Cardiovascular and respiratory diseases	10.80	8.83	14.00
Dermatologic diseases	7.39	7.21	7.00
Endocrine diseases	7.39	6.34	13.00
Eosinophilia and basophilia	8.52	5.47	4.00
Gastrointestinal and pancreatic diseases	12.50	14.93	13.00
Immune-mediated diseases	7.39	4.98	5.00
Immunosuppressive drugs***	5.68	8.83	18.00
Inflammatory conditions	39.77	35.82	33.00
Liver-associated abnormalities*	39.20	51.99	50.00
Neoplasia	3.98	5.10	9.00
NSAIDs***	1.70	2.99	21.00
Nutriceuticals***	1.14	0.25	25.00
Ophthalmologic diseases**	2.27	3.11	9.00
Orthopedic diseases***	5.68	9.83	29.00
Overt blood loss and anemia recovery	10.23	6.84	9.00
Recent seizures	5.51	6.16	7.00
Renal disease and proteinuria	9.66	12.06	15.00

NSAIDs indicates nonsteroidal anti-inflammatory drugs.
Symbols represent significant differences between groups A and B (*P < .05), and groups A and C (**P < .01; ***P < .001).

Pattullo et al. Reticulocytosis in nonanemic dogs: increasing prevalence and potential etiologies. Vet Clin Pathol (2015):26–36

IDEXX

JOURNAL OF SMALL ANIMAL PRACTICE
BSAVA
JSAP

PAPER

Reticulocytosis in non-anaemic cats and dogs

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Objective: To evaluate the proportion of blood samples diagnosed with reticulocytosis without anaemia in cats and dogs and report the aetiology and mortality rate of affected animals.

Materials and Methods: Retrospective multicentre study including haematological examination of 3956 cats and 11,087 dogs admitted to seven German veterinary clinics (2012 to 2014). The proportion of blood samples with reticulocytosis without anaemia was calculated, and after exclusion of multiple measurements of the same animal, clinical data were evaluated. Animals with reticulocytosis without anaemia were classified as healthy or diseased, and diseased patients were assigned to 12 disease groups. Pretreatment (*i.e.* non-steroidal anti-inflammatory drugs, glucocorticoids, dipyrone) was recorded.

Results: The proportion of blood samples with reticulocytosis without anaemia was 3·1% (124/3956) in cats and 4·4% (492/11,087) in dogs. Overall, 1·8% (2/111) of cats and 1·5% (7/458) of dogs with reticulocytosis without anaemia were healthy. Blood loss/anaemia, cardiac/respiratory disorders, gastrointestinal disorders and inflammatory disorders as well as cancer were the most frequent underlying diseases. Pretreatment was noted in 39·5% (43/111) of cats and 42·4% (194/458) of dogs. The mortality rate was 37·8% (42/111) in cats and 29·7% (136/458) in dogs with reticulocytosis without anaemia; the median survival time in non-survivors was 1 day (range: 0 to 376 days in cats, 0 to 444 days in dogs).

Clinical Significance: In both species, reticulocytosis without anaemia was observed in a low proportion of blood samples (dogs>cat). Though a bias towards sick animals is possible in our sample, reticulocytosis without anaemia was mainly seen in diseased animals and associated with a mortality rate of approximately one-third of patients.

Journal of Small Animal Practice (2018)
DOI: 10.1111/jsap.12831
Accepted: 3 January 2018

2018
7 German veterinary clinics (2012~2014)

無貧血但網織球增多的臨床調查

RWA: Reticulocytosis without anemia
(沒有貧血但網織球升高) 此調查排除紅 血球增多症動物

網織球數量 > 參考範圍 (貓: >50 K/uL; 狗: >110 K/uL)

N= 3956
RWA: 3·1% (124/3956)

N= 11,087
RWA: 4·4% (492/11,087)

Most frequent underlying diseases:

- Blood loss/Anaemia ← 出血,或從出血疾病中復原
- Cardiac/respiratory disorders
- Gastrointestinal disorders
- Inflammatory disorders
- Cancer

IDEXX

歸納出常見的伴隨疾病

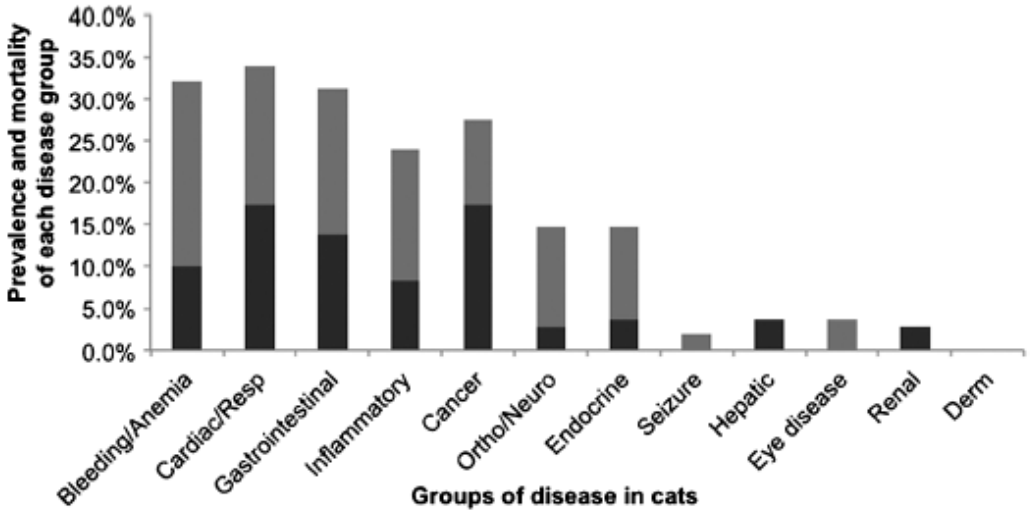
RWA in cats and dogs is rare and mainly associated with underlying, often severe, disease.

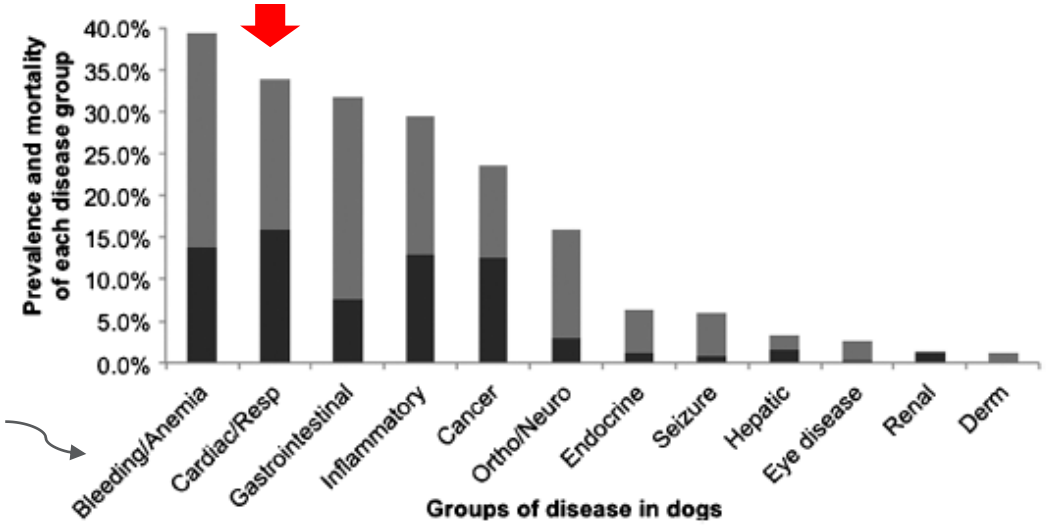
Table 1. Clinical data of cats and dogs with RWA

Factor	Cats (n=111)	Dogs (n=458)
Median age (range)	8 years (4 months to 18 years)	8 years (3 months to 16 years)
Female animals	53*/111 (47·8%)	259†/458 (56·6%)
Male animals	58†/111 (52·3%)	199§/458 (43·4%)
Healthy animals with RWA	2/111 (1·8%)	7/458 (1·5%)
Animals with one single disease	30/109 (27·5%)	147/451 (%)
Mortality rate	42/111 (37·8%)	136/458 (29·7%)
Median survival of non-survivors (range)	1 day (0 to 376 days)	1 day (0 to 444 days)
Animals with pretreatment¶	43/111 (38·7%)	194/458 (42·4%)

RWA Reticulocytosis without anaemia
*27 of 53 neutered
†117 of 259 neutered
†32 of 58 neutered
§57 of 199 neutered
¶Includes only previous treatment with NSAIDs, glucocorticoids, and dipyrone

J. Fuchs et. al. Reticulocytosis in non-anaemic cats and dogs. 2018. JSAP (59): 480-489.





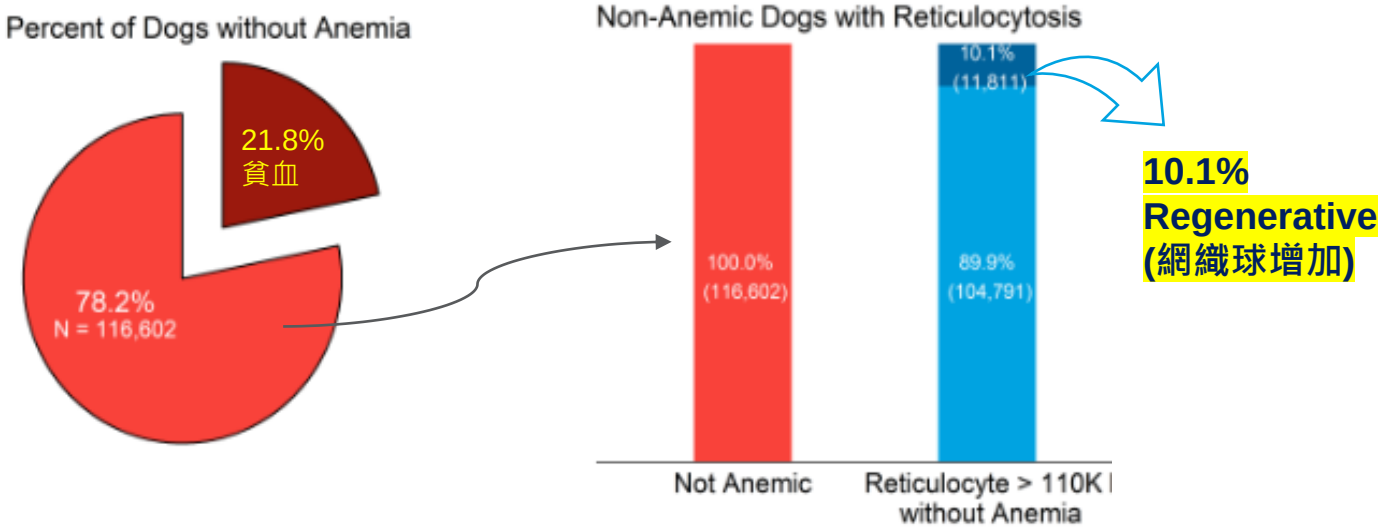
淺灰色=存活比例

出血,或從出血疾病中復原

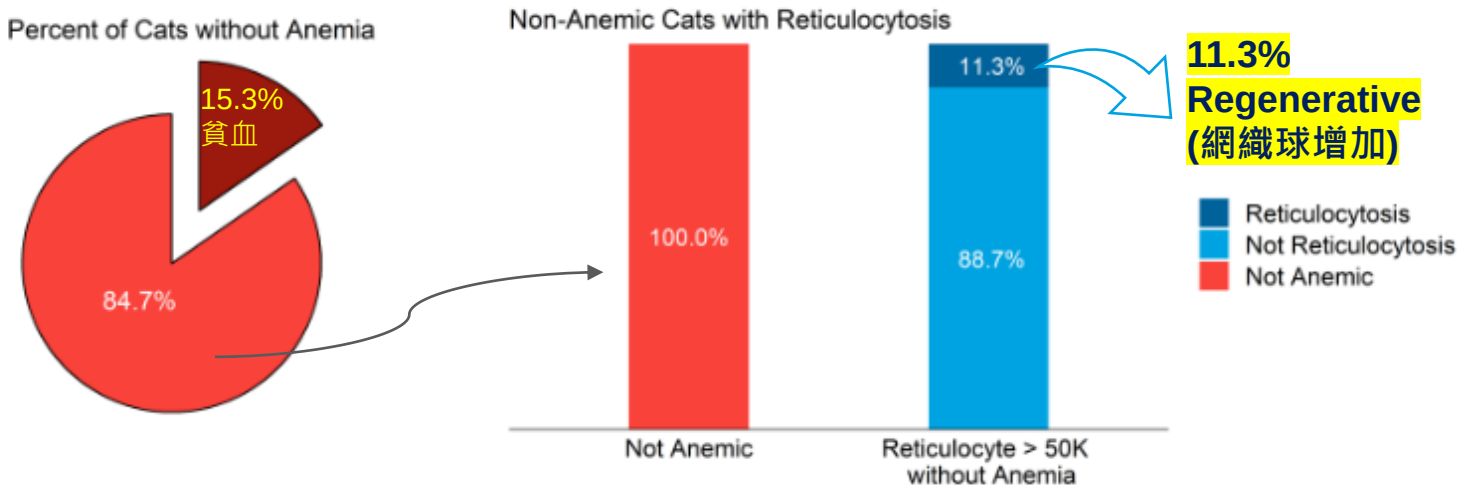
在台灣有多少比例的無貧血案例網織球增加呢?

Unpublished Taiwan IDEXX ProCyte Dx bigdata (2018-2020)

N=149,074

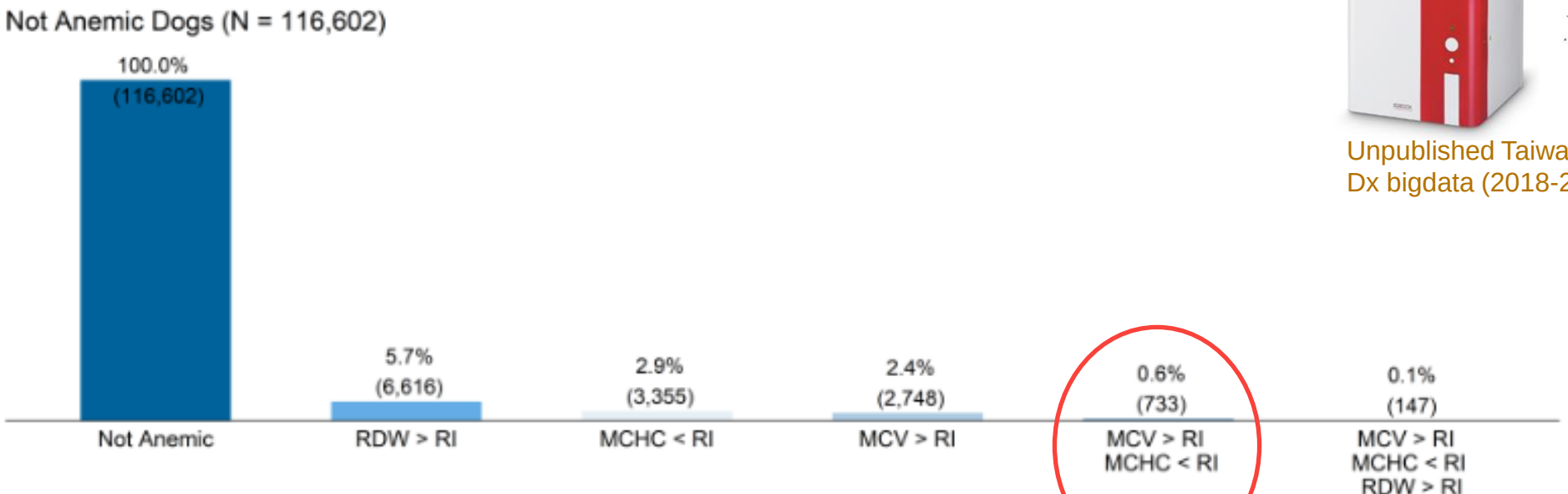


N=116,951

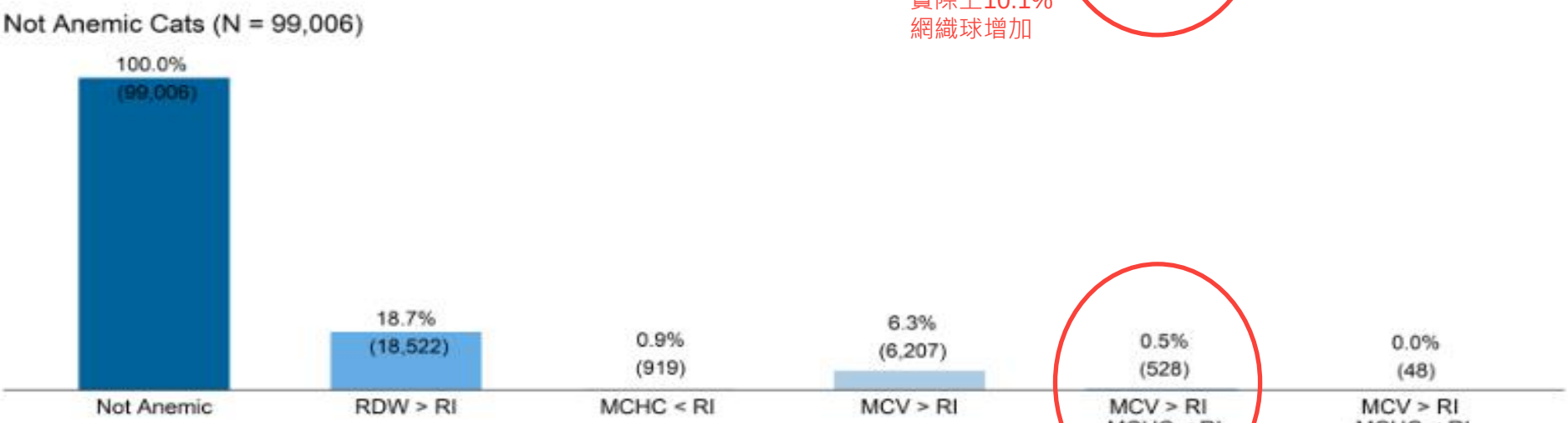


如果不看網織球的數量有辦法發現嗎?

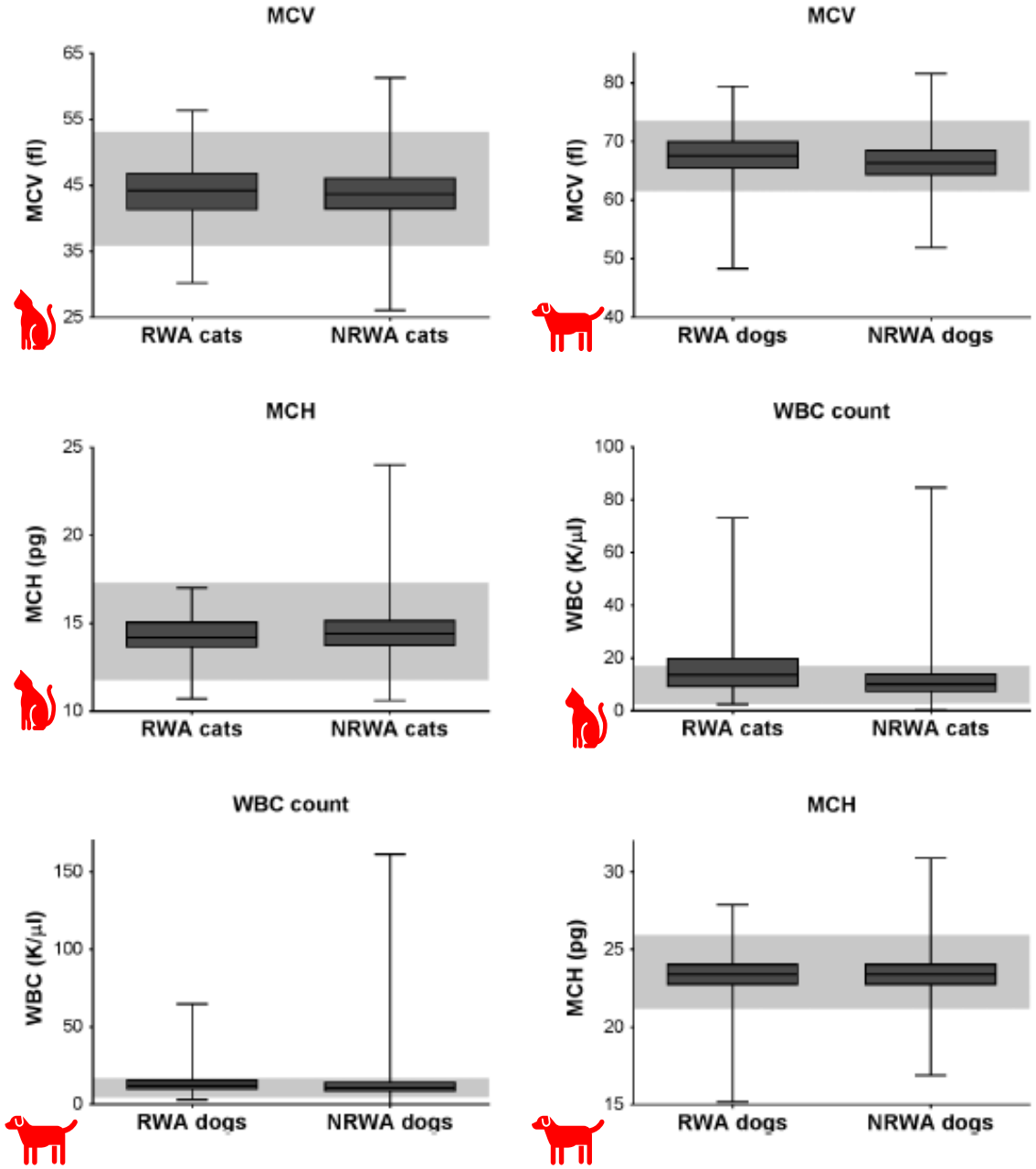
Unpublished Taiwan IDEXX ProCyte Dx bigdata (2018-2020)



實際上10.1%
網織球增加



實際上11.1%
網織球增加



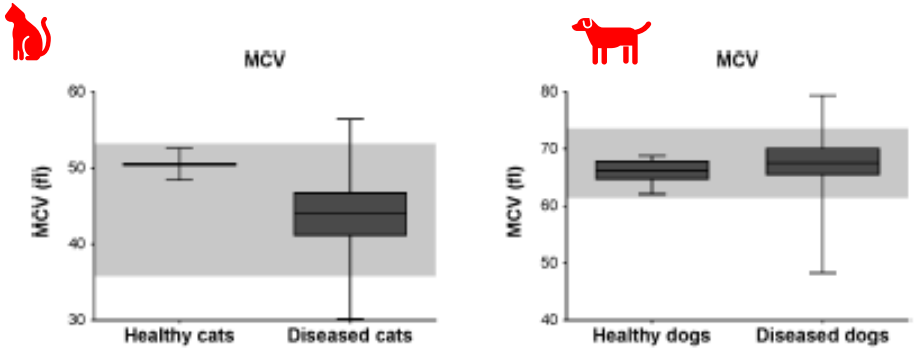
比較有無網織球增加的族群
沒有大球(MCV↑)
也沒有低染(MCH↓)

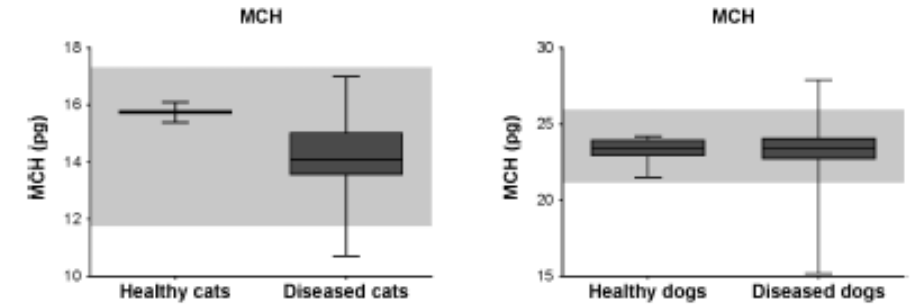
NRWA: None Reticulocytosis without anemia
(沒有貧血網織球**沒**升高)

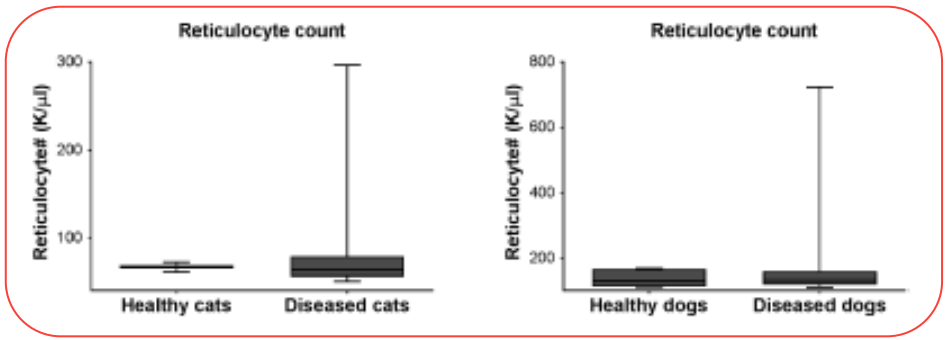
RWA: Reticulocytosis without anemia
(沒有貧血但網織球升高)

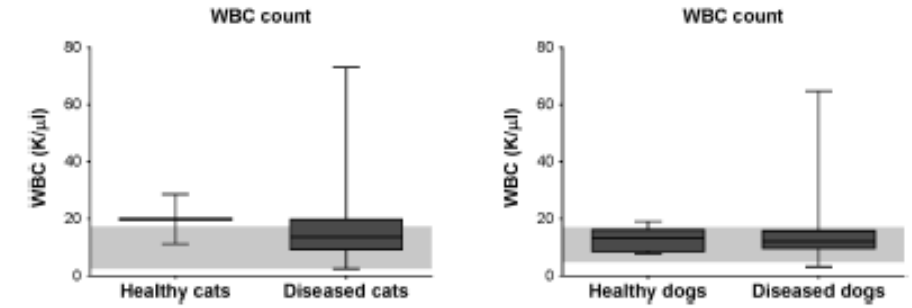
網織球數量 > 參考範圍 (貓: >50 K/uL; 狗: >110 K/uL)

J. Fuchs et. al. Reticulocytosis in non-anaemic cats and dogs. 2018. JSAP (59): 480-489.





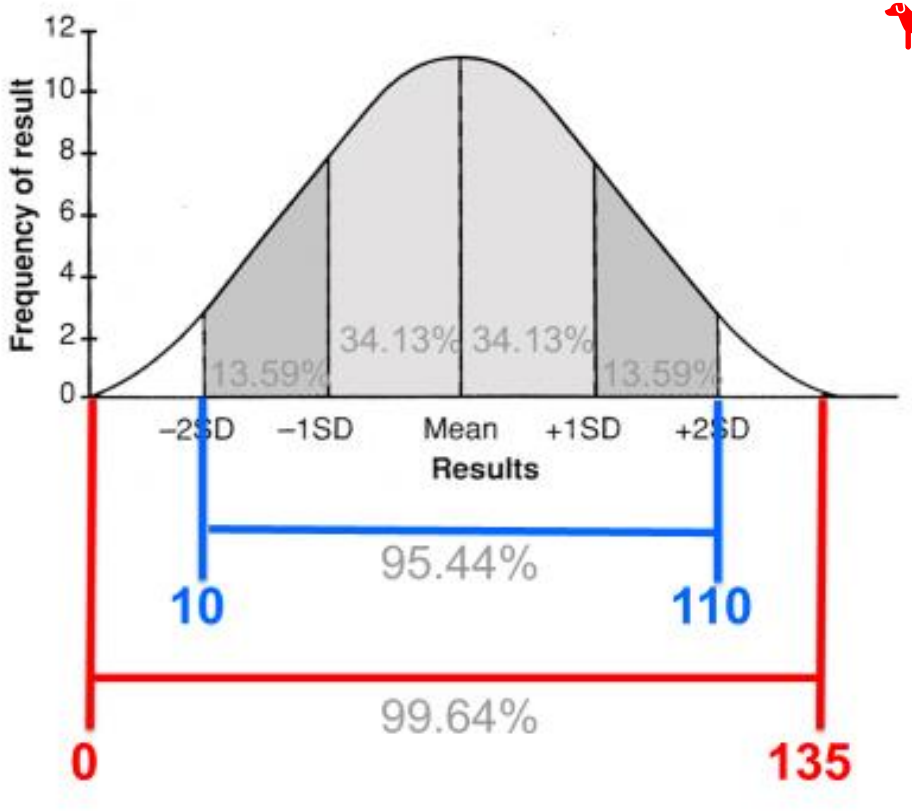




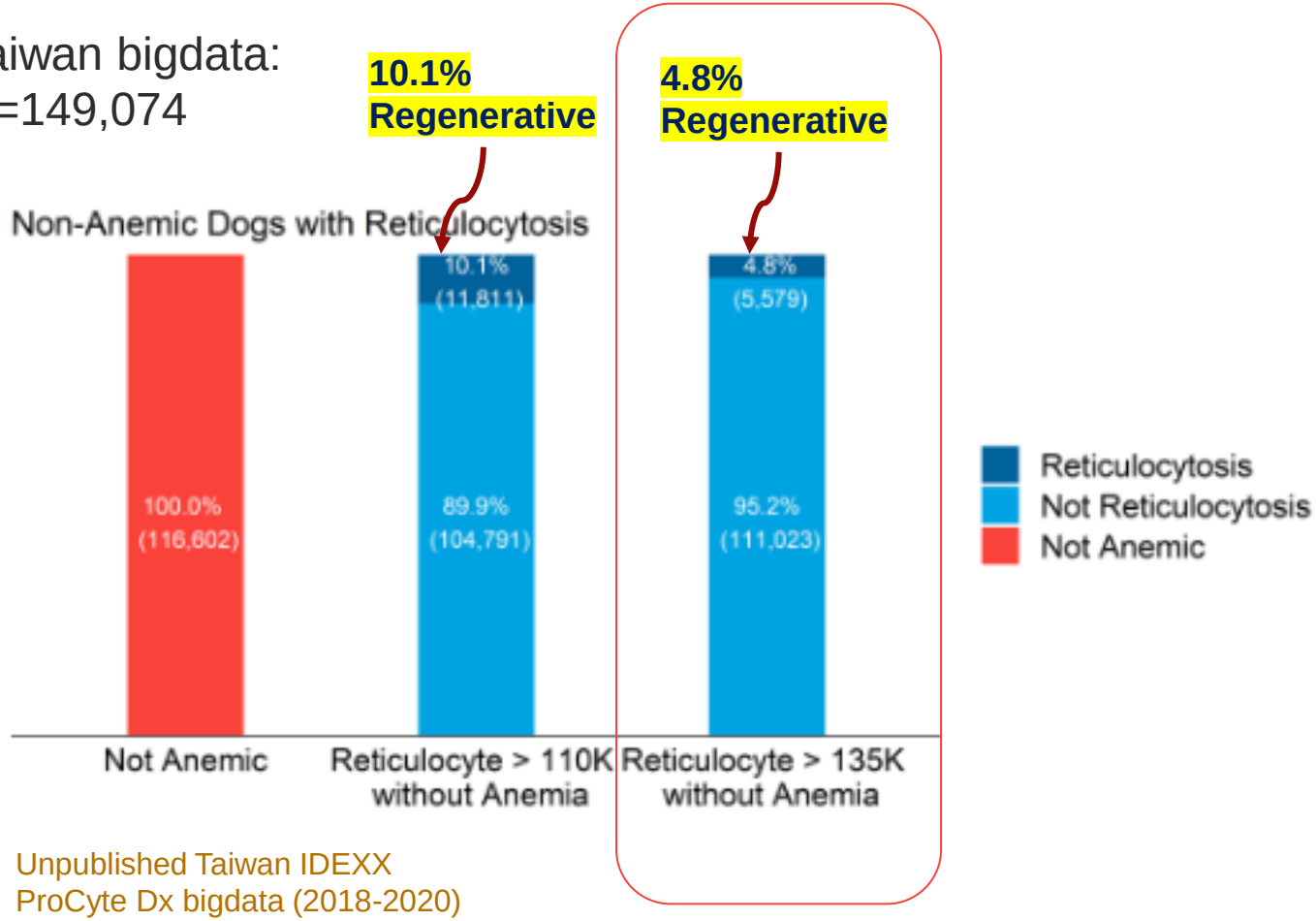
比較健康與不健康的犬貓，網織球的分佈有些差異

J. Fuchs et. al. Reticulocytosis in non-anaemic cats and dogs. 2018. JSAP (59): 480-489.

如果這隻狗正常RET就是這麼高，怎麼辦?



Taiwan bigdata:
N=149,074



Unpublished Taiwan IDEXX
ProCyte Dx bigdata (2018-2020)

Hematology

Click to view Differentials

	3/3/22 5:11 PM	3/2/22 11:12 AM	2/25/22 3:06 PM	2/25/22 3:00 PM	2/11/22 3:47 PM	1/28/22 2:55 PM	1/22/22 2:18 PM	1/19/22 10:15 AM	12/20/21 1:19 PM	12/20/21 10:36 AM
RBC	7.73	7.81	8.15	8.12	8.07	8.11	7.84	7.35	8.07	7.91
Hematocrit	51.5	53.6	55.9	53.8	56.2	52.3	54.2	48.6	52.6	54.2
Hemoglobin	17.4	17.6	18.6	18.5	18.1	19.2	18.4	16.7	19.7	17.9
MCV	66.6	68.6	68.6	66.3	69.6	64.4	69.1	66.1	65.2	68.5
MCH	22.5	22.5	22.8	22.8	22.4	23.7	23.5	22.7	24.4	22.6
MCHC	33.8	32.8	33.3	34.3	32.2	36.8	33.9	34.4	37.5	33.0
RDW	19.6	18.9	19.4	21.0	18.7	21.2	18.9	18.1	21.7	19.1
% Reticulocyte	2.5	2.0	2.1	1.8	1.6	1.6	1.4	1.5	2.4	2.2
Reticulocytes	**194.0**	**156.2**	**171.2**	**149.6**	**130.7**	**127.7**	**112.9**	108.8	**194.5**	**174.8**
Reticulocyte Hemoglobin	25.5	25.5	23.6		23.4		24.8	23.2		25.1
WBC	**18.66**	**17.79**	**18.85**	**19.47**	13.21	14.33	12.85	13.29	16.02	14.23
% Neutrophils	70.3	69.9	69.9	67.4	74.2	65.3				
% Lymphocytes	19.6	19.6	18.7	17.3	16.0	20.8				
% Monocytes	9.1	9.5	9.1	14.5	7.0	13.5				
% Eosinophils	0.9	1.0	1.6	0.7	2.2	0.2	1.9	1.6	0.2	1.8
% Basophils	0.1	0.0	0.7	0.1	0.6	0.2	0.3	0.2	0.3	0.3
Neutrophils	**13.13**	**12.43**	**13.18**	**13.12**	9.81	9.36	9.02	9.40	10.99	9.74
Lymphocytes	3.65	3.49	3.52	3.38	2.11	2.98	2.35	2.36	2.91	2.97
Monocytes	**1.70**	**1.69**	**1.71**	**2.82**	0.92	**1.94**	**1.20**	**1.29**	**2.05**	**1.22**
Eosinophils	0.17	0.18	0.31	0.14	0.29	**0.03**	0.24	0.21	**0.03**	0.26
Basophils	0.01	0.00	**0.13**	0.02	0.08	0.03	0.04	0.03	0.04	0.04

RET reference range (95%): **10K-110K /uL**
(99%) RET **> 135K /uL**

#2 BiBi 的故事

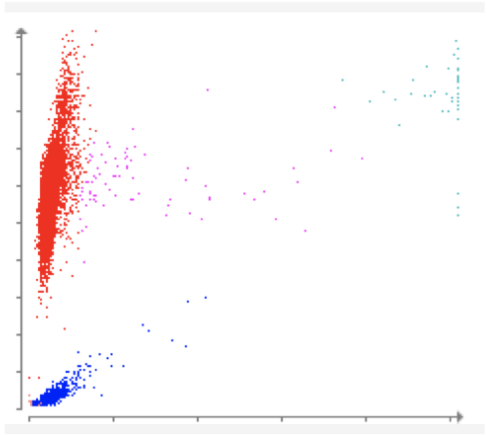
Bibi

- 13y/o poodle MN 4.6kg
- 健康檢查就診

- 一切都很好喔

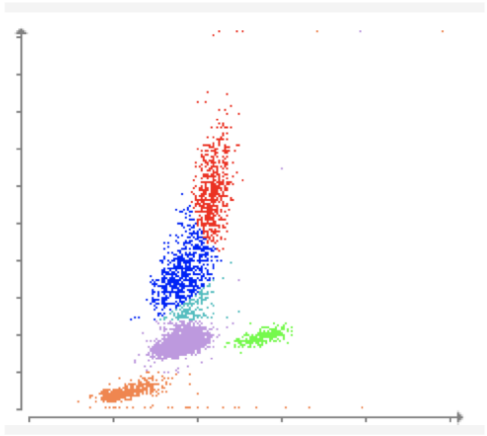
9/10/21 **11:34 AM**

TEST	RESULT	REFERENCE VALUE	
RBC	6.97	5.65 - 8.87 M/µL	
Hematocrit	49.8	37.3 - 61.7 %	
Hemoglobin	16.0	13.1 - 20.5 g/dL	
MCV	71.4	61.6 - 73.5 fL	
MCH	23.0	21.2 - 25.9 pg	
MCHC	32.1	32.0 - 37.9 g/dL	
RDW	19.3	13.6 - 21.7 %	
% Reticulocyte	0.4	%	
Reticulocytes	24.4	10.0 - 110.0 K/µL	
Reticulocyte Hemoglobin	26.3	22.3 - 29.6 pg	
WBC	8.79	5.05 - 16.76 K/µL	
% Neutrophils	77.2	%	
% Lymphocytes	9.4	%	
% Monocytes	7.8	%	
% Eosinophils	3.6	%	
% Basophils	2.0	%	
Neutrophils	6.77	2.95 - 11.64 K/µL	
Lymphocytes	**0.83**	**1.05 - 5.10 K/µL**	L
Monocytes	0.69	0.16 - 1.12 K/µL	
Eosinophils	0.32	0.06 - 1.23 K/µL	
Basophils	**0.18**	**0.00 - 0.10 K/µL**	H
Platelets	309	148 - 484 K/µL	
PDW	10.7	9.1 - 19.4 fL	
MPV	11.1	8.7 - 13.2 fL	
Plateletcrit	0.34	0.14 - 0.46 %	



- WBC
- RBC
- PLT
- RETICS
- RBC_FRAG

Download



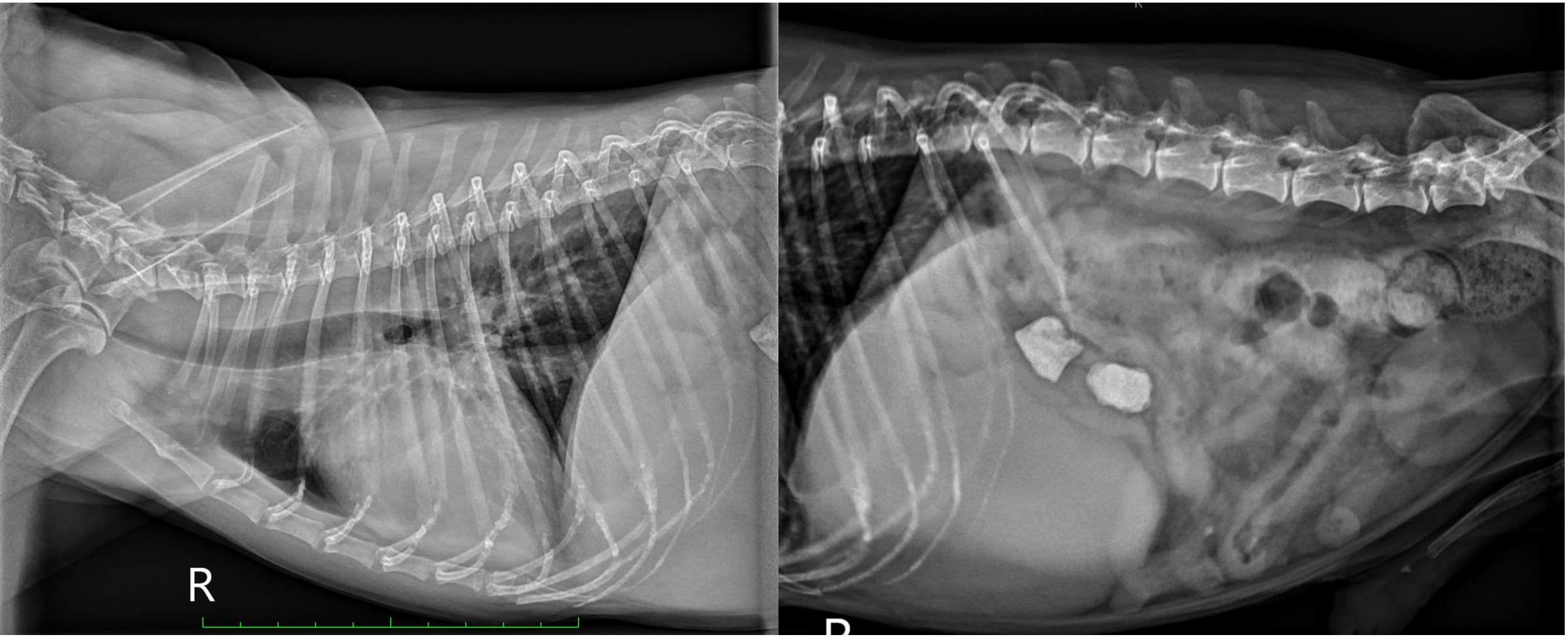
- EOS
- LYM
- URBC
- BASO
- NEU
- MONO

TEST	RESULT	REFERENCE VALUE
Glucose	89	70 - 143 mg/dL
Creatinine	1.0	0.5 - 1.8 mg/dL
BUN	**36**	**7 - 27 mg/dL**
BUN: Creatinine Ratio	37	
Phosphorus	5.2	2.5 - 6.8 mg/dL
Calcium	10.0	7.9 - 12.0 mg/dL
Sodium	150	144 - 160 mmol/L
Potassium	4.3	3.5 - 5.8 mmol/L
Na: K Ratio	35	
Chloride	116	109 - 122 mmol/L
Total Protein	7.0	5.2 - 8.2 g/dL
Albumin	3.5	2.2 - 3.9 g/dL
Globulin	3.5	2.5 - 4.5 g/dL
Albumin: Globulin Ratio	1.0	
ALT	**156**	**10 - 125 U/L**
ALP	79	23 - 212 U/L
GGT	0	0 - 11 U/L
Bilirubin - Total	0.5	0.0 - 0.9 mg/dL
Cholesterol	263	110 - 320 mg/dL
Amylase	514	500 - 1,500 U/L
Lipase	1,431	200 - 1,800 U/L
Osmolality	305	mmol/kg

TEST	RESULT
Collection	Cystocentesis
Color	Straw
Clarity	Slightly Cloudy
Specific Gravity	1.033
pH	5.0
Urine Protein	neg
Glucose	neg
Ketones	neg
Blood / Hemoglobin	neg
Bilirubin	neg
Urobilinogen	norm
Leukocyte Esterase	neg
White Blood Cells	<1 /HPF

TEST	RESULT
Red Blood Cells	1 /HPF
Bacteria, Cocci	None detected
Bacteria, Rods	None detected
Squamous Epithelial Cells	None detected
Non-Squamous Epithelial Cells	<1 /HPF
Hyaline Casts	Suspect presence
Non-Hyaline Casts	None detected
Calcium Oxalate Dihydrate Crystals	None detected
Struvite Crystals	None detected
Ammonium Biurate Crystals	None detected
Bilirubin Crystals	None detected
Unclassified Crystals	None detected

IDEXX



Bibi

- 13y/o poodle MN 4.6kg
- 健康檢查就診

- Echo: MR, TR,
- MMVD stage B2
- Rx: pimobendan

- 發現巨大膽囊，膽道懷疑阻塞
- 建議手術膽囊摘除

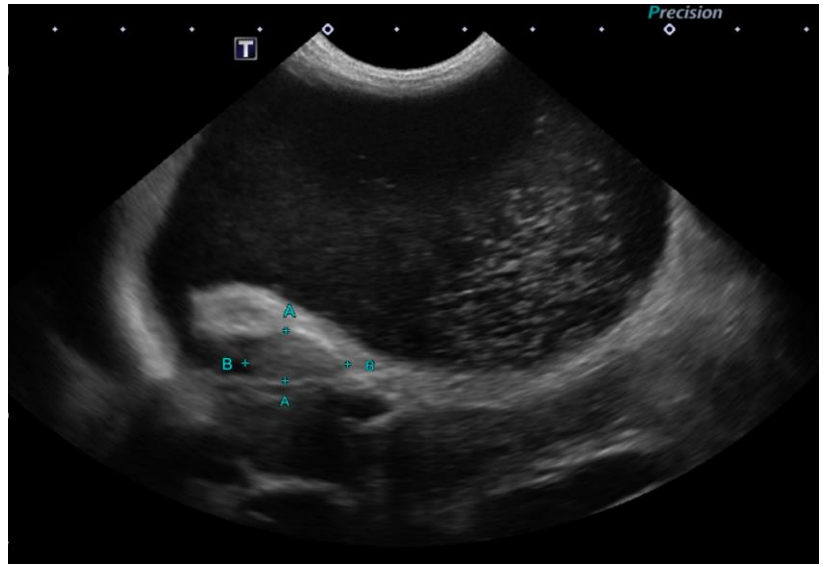
DIAGNOSIS

Gallbladder: Cholecystitis, lymphoplasmacytic, diffuse, moderate with mucosal hyperplasia, bile stasis, numerous choleliths, and extracellular bacterial within the bile.

Cystic duct: Choledochitis, proliferative, diffuse, moderate with mucosal hyperplasia, bile stasis, few choleliths and extracellular bacteria.

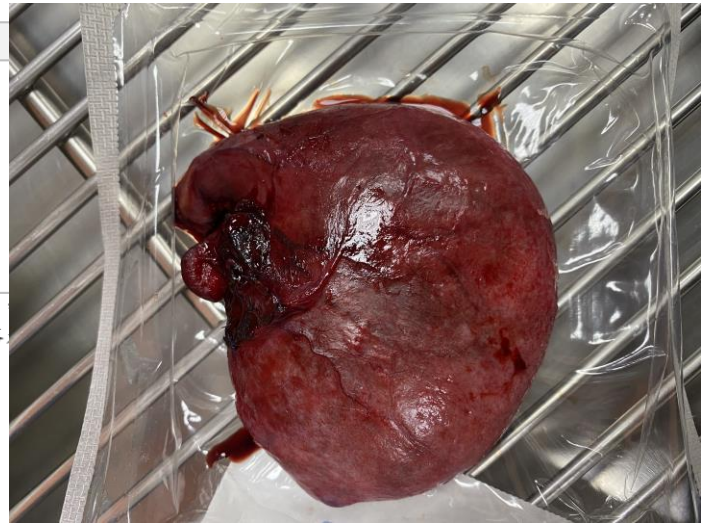
COMMENTS

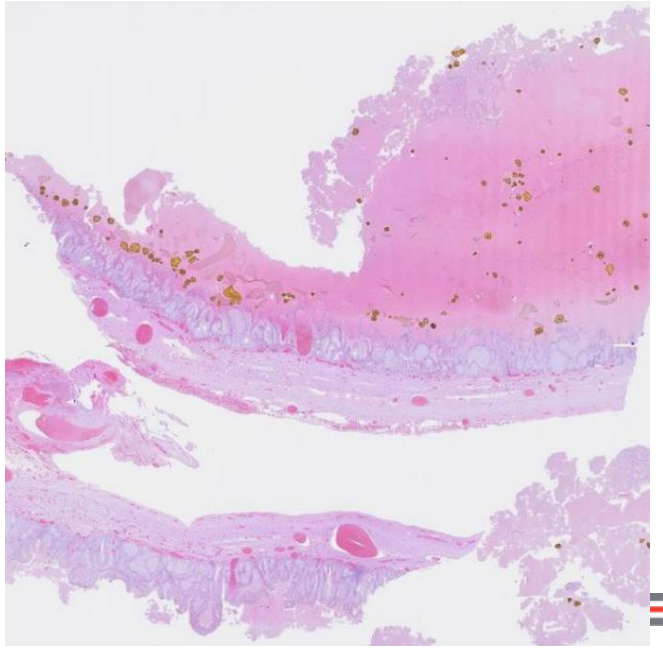
The changes in the gallbladder and cystic duct are similar. Cholecystitis is uncommon in the dog and is often associated with concurrent cholelithiiasis. Choleystitis though to tbe cause by relux of intestinal bacteria into the gallbladder bia the bile ducts. Cholelith formation often accompanies chronic gallbladder infection, presumptively as a response to diminished resorptive capacity of the proliferative gallbladder epithelium for bile salts. There is no neoplasia in the examined sections. If there is continued problems with the external biliary system following removal of the gallbladder and cystic duct, we strongly recommend culture and sensitivity of bile in this case.

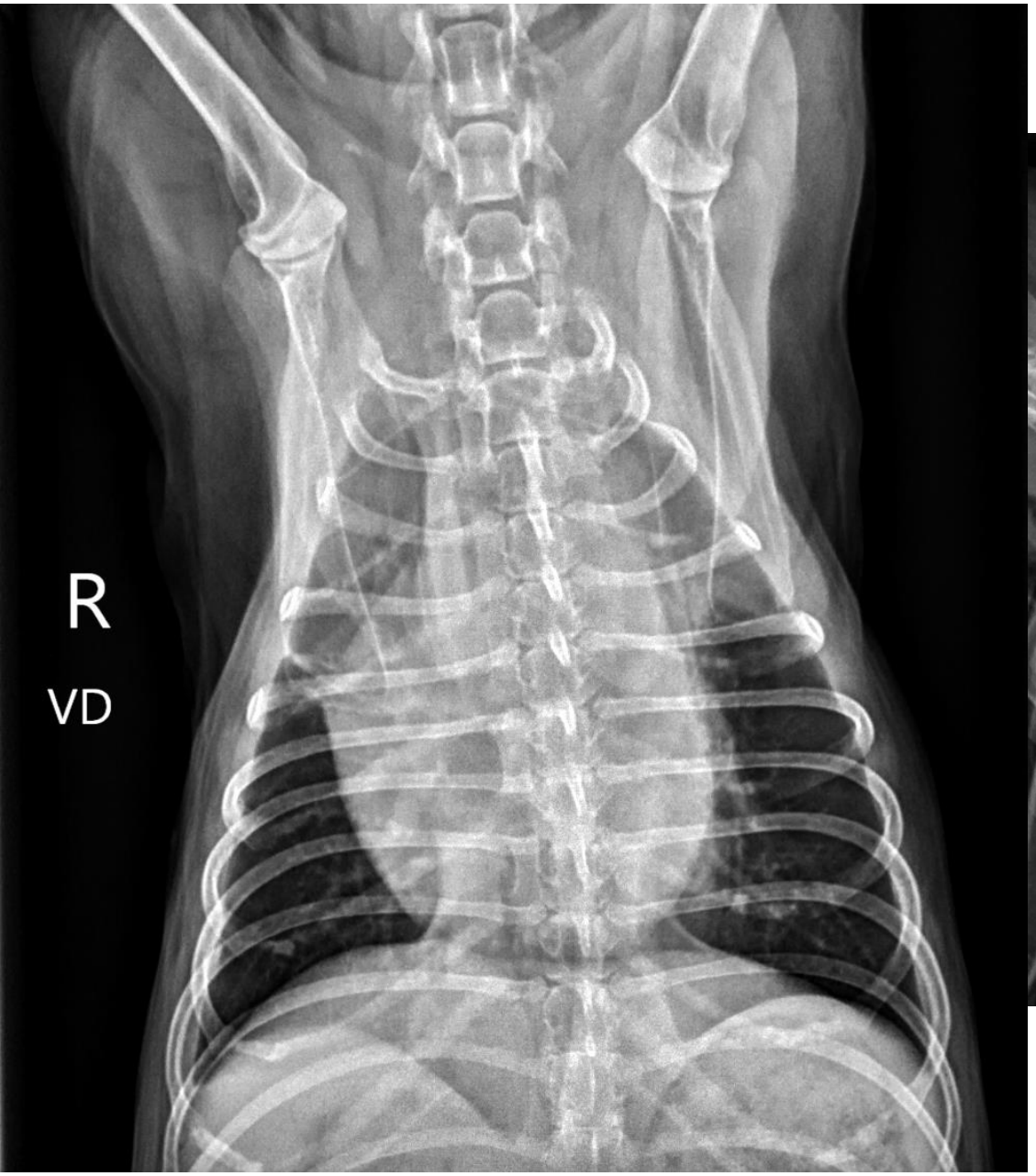


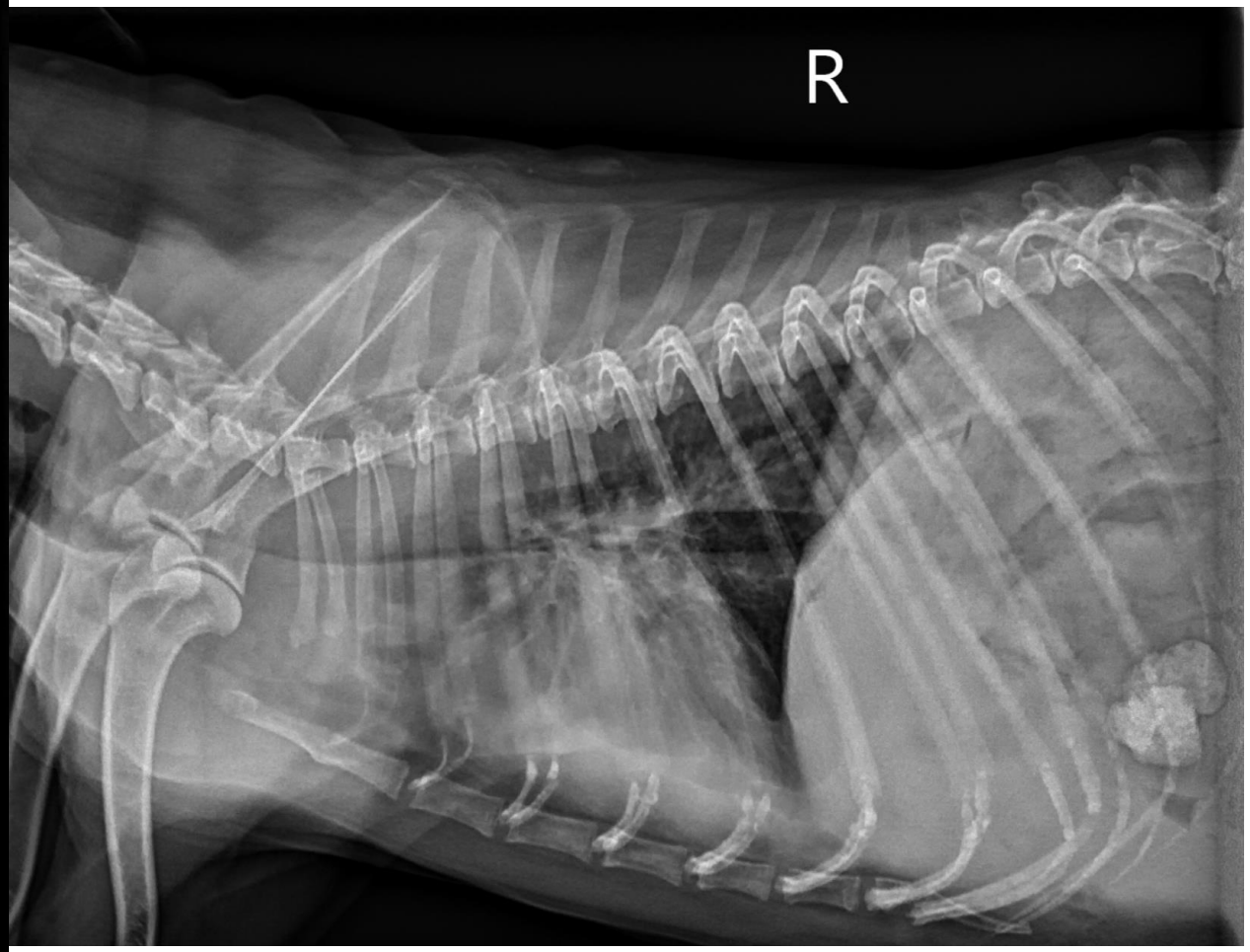
樣品	檢體直接抹片半定量*	病原鑑定與半定量生長結果†
(1)	(2+) gram (-) bacilli (2+) gram (+) cocci	(4+) *Escherichia coli* (3+) *Enterococcus faecium*

*(1+) 100 個油鏡視野下 1–9 個細菌，(2+) 10 個油鏡視野下 1–9 個細菌，(3+) 每油鏡視野下 1–9 個細菌
第二畫線區菌落 1-5 或第一區大於 10，(3+) 第三畫線區菌落 1-5 或第二區大於 5，(4+) 第三畫線區菌落









2021/9/28

9/10 初診

9/24 膽囊摘除手術，出血量大，低血壓

9/25 住院 輸血125ml 嗎啡貼片 cefazolin，famotidine，pimobendan，cerenia

9/28 咳嗽喘症狀 少量胸水 furosemide 1mg//kg MMVD stage C

9/28 更換抗生素 augmentin, Cefixime for 6 weeks

10/1 出院 心臟藥 抗生素

2/8-2/11 急性肺水腫住院
增加furosemide 3mg/kg

目前穩定心臟病回診中

Antimicrobial agents	a	b	c	d	Antimicrobial agents	a	b	c	d	Antimicrobial agents	a	b	c	d
Penicillin (P)					Cefazolin (CZ)	R	R			Tetracycline (T)				
Ampicillin and amoxicillin (AM)*	R	R			Cephalexin (CL)	R	R			Doxycycline (DO)	I	R		
Piperacillin (PRL)					Cefadroxil (CFR)	R	R			Minocycline (MH)				
Oxacillin (OX)					Cefuroxime (CXM)					Erythromycin (E)				
Ampcillin/Sulbactam (SAM)					Cefovecin (CVN)					Azithromycin (AZM)	R	R		
Amoxicillin/Clavulanate (AMC)	I	R			Cefotaxime (CTX)	S	R			TMP/SMX (Co-trim)†	R	R		
Piperacillin/Tazobactam (TZP)					Ceftriaxone (CRO)					Clindamycin (DA)*	R	R		
Amikacin (AK)					Ceftazidime (CAZ)					Rifampin (RA)				
Gentamicin (CN)					Cefixime (CFM)	S	R			Vancomycin (VA)	R	S		
Tobramycin (TOB)					Ceftiofur (EFT)					Linezolid (LZD)	R	S		
Neomycin (NE)					Cefquinome (CEQ)					Chloramphenicol (C)				
Ciprofloxacin (CIP)	R	R			Cefepime (FEP)					Mupirocin (MUP)				
Enrofloxacin (ENR)	I	R			Imipenem (IPM)	S	R			Fusidic acid (FC)				
Norfloxacin (NOR)					Meropenem (MEM)	S	R			Nitrofurantoin (F)				
Ofloxacin (OFX)					Aztreonam (ATM)					Metronidazole (MTZ)*				
Levofloxacin (LEV)					Colistin (CT)					Quinupristin-dalfopristin				
Moxifloxacin (MXF)					Polymyxin B (PB)					Fosfomycin				
Marbofloxacin														

Hematology (Click to view Differentials)	1/29/22 5:10 PM	11/17/21 2:23 PM	10/20/21 11:51 AM	10/6/21 2:50 PM	10/6/21 2:37 PM	9/28/21 6:35 PM	9/27/21 3:47 PM	9/27/21 9:32 AM	9/26/21 9:40 AM	9/25/21 9:47 AM	9/24/21 8:06 PM	9/10/21 11:34 AM
RBC	5.63	6.19	6.03	4.86	4.86	4.51	4.46	4.43	4.42	3.52	5.66	6.97
Hematocrit	40.0	43.2	44.2	32.9	36.6	30.7	30.0	29.5	29.7	24.8	42.7	49.8
Hemoglobin	12.8	14.1	14.2	12.5	11.4	10.5	10.3	10.2	10.2	8.4	13.1	16.0
MCV	71.0	69.8	73.3	67.6	75.3	68.1	67.4	66.6	67.2	70.5	75.4	71.4
MCH	22.7	22.8	23.5	25.7	23.5	23.3	23.1	23.0	23.1	23.9	23.1	23.0
MCHC	32.0	32.6	32.1	38.0	31.1	34.2	34.3	34.6	34.3	33.9	30.7	32.1
RDW	20.5	16.9	19.1	20.2	22.3	19.1	15.4	16.9	16.9	16.7	18.8	19.3
% Reticulocyte	4.4	0.9	2.1	5.0	4.7	3.7	2.2	2.1	1.9	2.7	3.2	0.4
Reticulocytes	247.7	55.7	126.6	244.3	229.9	166.0	98.9	91.3	84.4	93.6	181.7	24.4
Reticulocyte Hemoglobin	24.3	23.3	23.8		23.0	23.3		25.8	22.7	24.2	23.6	26.3
WBC	16.40	9.27	11.92	10.89		2.11			5.02	4.04	13.49	8.79
% Neutrophils	78.8	77.5	75.8	77.0		9.8				*75.3	84.4	77.2
% Lymphocytes	11.1	7.7	7.8	6.8		2.1				*18.6	7.9	9.4
% Monocytes	9.2	11.1	11.4	13.6	*12.8	*7.2	4.6	*9.1	*6.4	*5.4	7.1	7.8
% Eosinophils	0.8	2.9	3.0	2.3	*1.8	0.7	0.5	1.4	2.0	0.7	0.5	3.6
% Basophils	0.1	0.8	2.0	0.3	*0.1	0.2	0.3	0.0	0.0	0.0	0.1	2.0
Neutrophils	12.92	7.19	9.03	8.39	*8.76	*9.66	7.62	*6.69	*3.59	*3.04	11.38	6.77
Lymphocytes	1.82	0.71	0.93	0.74	*2.30	*1.47	1.12	*1.50	*1.01	*0.75	1.06	0.83
Monocytes	1.51	1.03	1.36	1.48	*1.66	*0.87	0.43	*0.83	*0.32	*0.22	0.96	0.69
Eosinophils	0.13	0.27	0.36	0.25	*0.23	0.09	0.05	0.13	0.10	0.03	0.07	0.32
Basophils	0.02	0.07	0.24	0.03	*0.01	0.02	0.03	0.00	0.00	0.00	0.02	0.18
Platelets	457	434	704	71	*48	*15	44	*22	15	21	237	309
PDW	11.2	9.7	10.3	15.8	- --.--	- --.--	13.4	- --.--	9.4	10.4	13.8	10.7
MPV	11.0	10.7	11.1	10.6	15.9	15.9	- --.--	14.8	12.5	12.0	11.8	11.1
Plateletcrit	0.50	0.46	0.78	0.08	0.08	0.02	- --.--	0.03	0.02	0.03	0.28	0.34

HCT開始成長

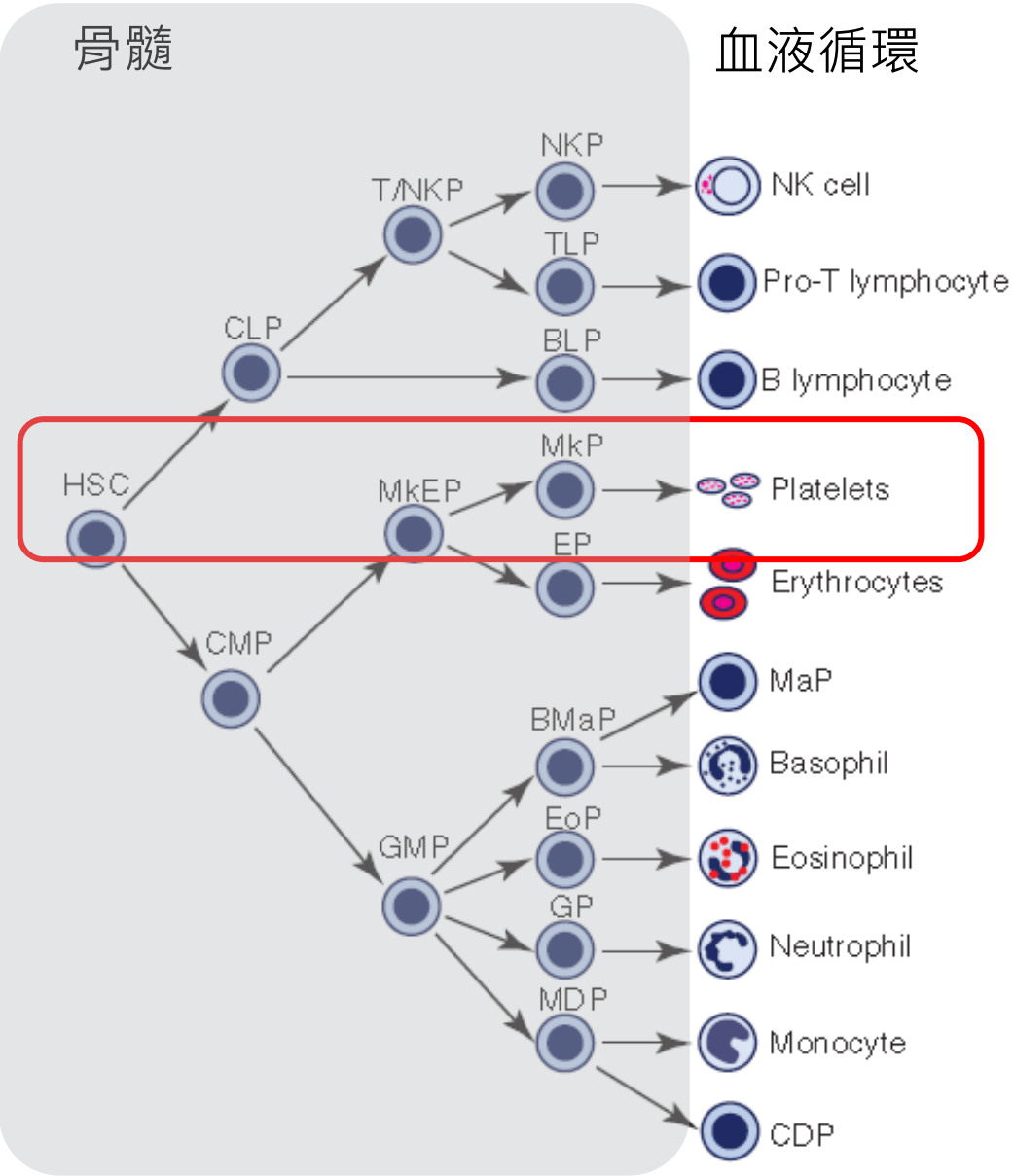
4天後，網織球開始釋出

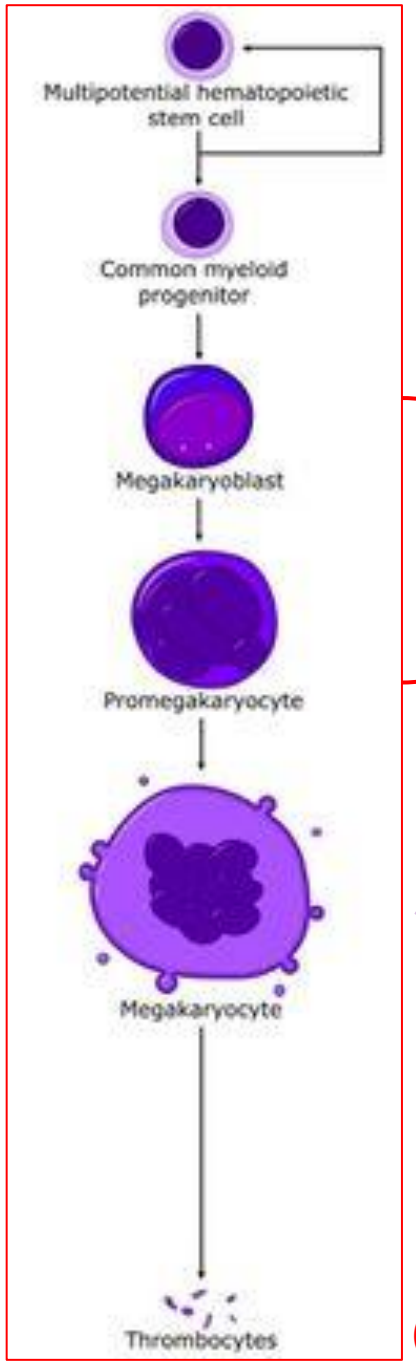
輸血

出血!!

血小板的生成

JW Harvey. Veterinary Hematology: A Diagnostic Guide and Color Atlas





HSC

CMP

MkP

其他促進PLT生成的因子

SCF,
Flt3L
IL-3
GM-CSF
IL-11
EPO

炎症反應的時候，IL-6的時候使肝臟生成更多TPO

IL-6

TPO

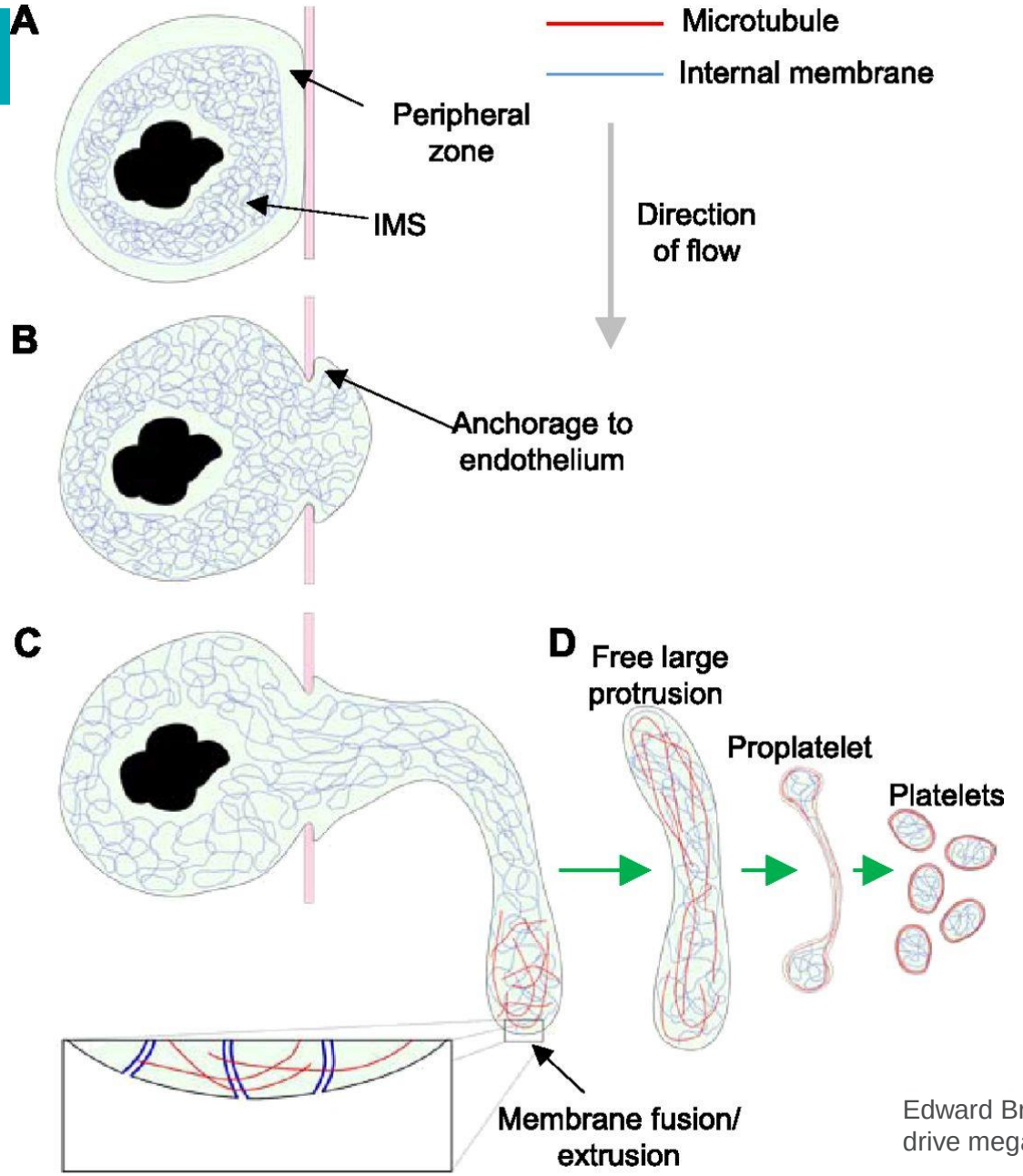
TPO: Thrombopoietin
(血小板生成素)
主要: 肝臟生成，其次腎臟與骨髓stroma cell。

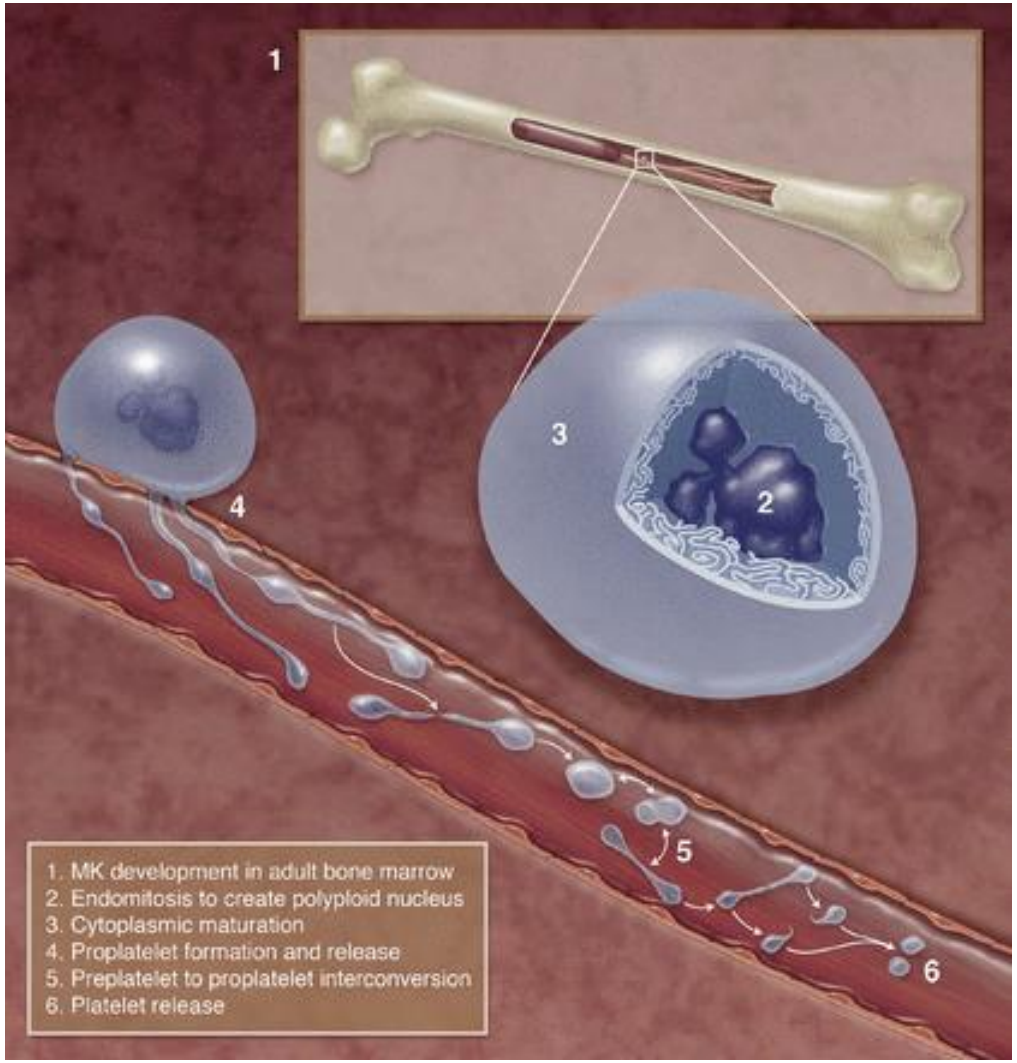
犬: 一顆Megakeryocyte
約生成1000-3000 個
PLT

(Platelet) 血小板

https://en.wikivet.net/Thrombopoiesis

血小板的生成





https://cellbiology.med.unsw.edu.au/cellbiology/index.php/2016_Group_1_Project

Edward Brown, Leo M Carlin, Claus Nerlov, Cristina Lo Celso, Alastair W Poole. Multiple membrane extrusion sites drive megakaryocyte migration into bone marrow blood vessels. Life science alliance: 2018

JW Harvey. Veterinary Hematology: A Diagnostic Guide and Color Atlas

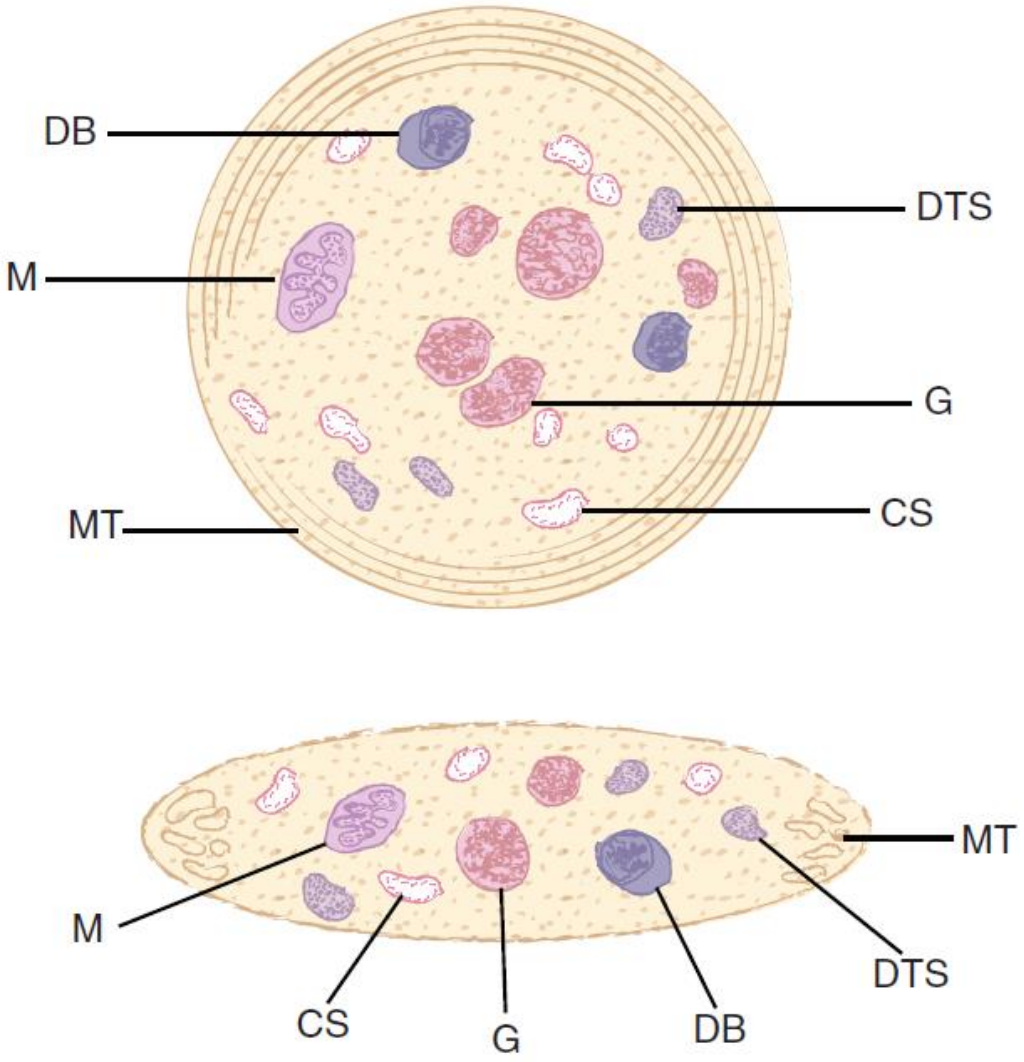


FIGURE 7-6

Platelet ultrastructure. DB, dense bodies; M, mitochondria; MT, microtubules; DTS, dense tubular system; G, granules; CS, canalicular system.

血小板的功能

- 形成血塊，堵住破掉的血管
- 啟動凝血作用機制

血小板在狗的生命周期大約是4-6天，
拿掉脾臟之後，平均可以變成8天。

在人:
PLT < 150,000/uL 就有出血風險
PLT > 600,000/uL 增加血栓的風險

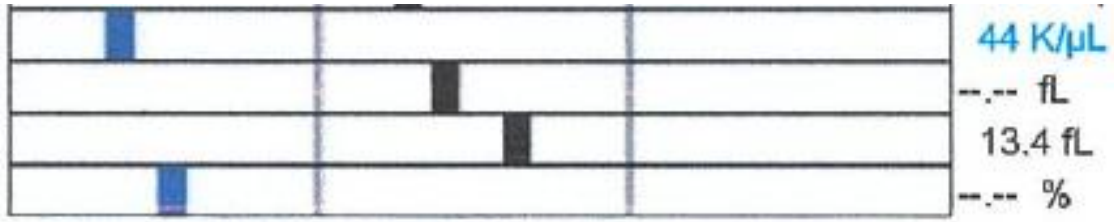
Sunita R. Patel, John H. Hartwig, Joseph E. Italiano Jr. The biogenesis of platelets from megakaryocyte proplatelets. J Clin Invest. 2005;115(12):3348-3354.

在犬貓:
PLT < 50,000/uL 就有出血風險
PLT < 10,000/uL 出血風險很高

https://eclinpath.com/hemostasis/disorders/platelet-numbers/

血小板指數(PLT indices)怎麼看??

PLT	71 K/µL	148 - 484	低
MPV	10.6 fL	8.7 - 13.2	
PDW	15.8 fL	9.1 - 19.4	
PCT	0.08 %	0.14 - 0.46	低



RBC	PLT的質量	○ PLT 血小板數量: 總共有幾顆血小板..
MCV	PLT的品質	○ MPV 平均血小板容積: 平均來說一顆血小板有多大? (平均)
RDW	PLT的品質	○ PDW 血小板分布寬度: 最大和最小的血小板差多少? (標準差)
HCT	PLT的質量	○ PCT 血小板總體積: 所有的血小板加起來的體積有多少?

血小板特立獨行的品種 (犬)

- **Cyclic Hematopoiesis:** Gray Collies
- **Inherited macrothrombocytopenia:** Cavalier King Charles Spaniel, Norfolk, Cairn Terriers, other breeds (e.g. Labrador Retrievers, Poodle, Chihuahua, Shih Tzu, Maltese Terrier, Jack Russell Terriers), Akitas (abnormal shaped PLT)
- **Breed-associated thrombocytopenia:** Greyhounds

https://eclinpath.com/hemostasis/disorders/platelet-numbers/

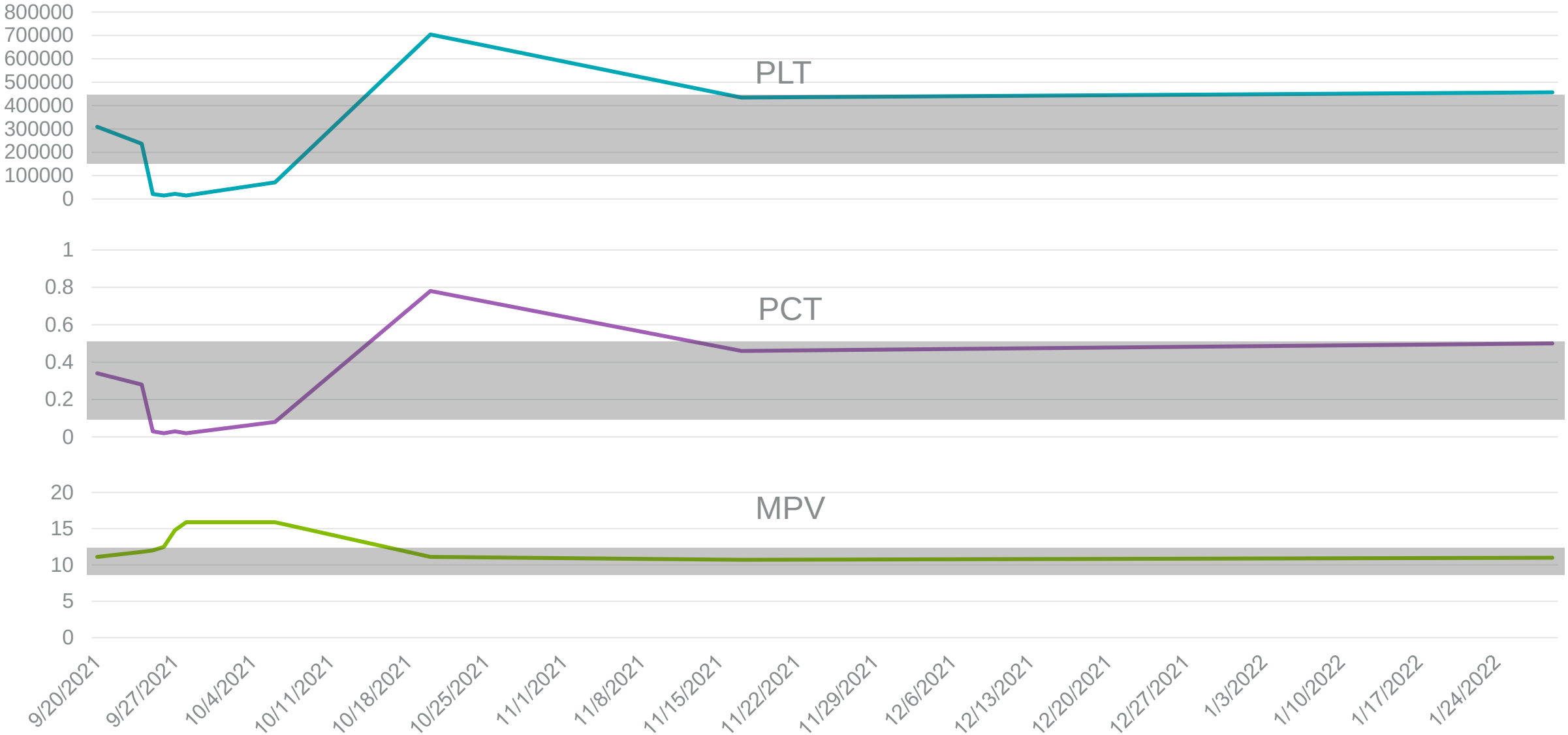
PLT的質量 ○ PLT 血小板數量: 總共有幾顆血小板..

PLT的品質 ○ MPV 平均血小板容積: 平均來說一顆血小板有多大? (平均)

PLT的品質 ○ PDW 血小板分布寬度: 最大和最小的血小板差多少? (標準差)

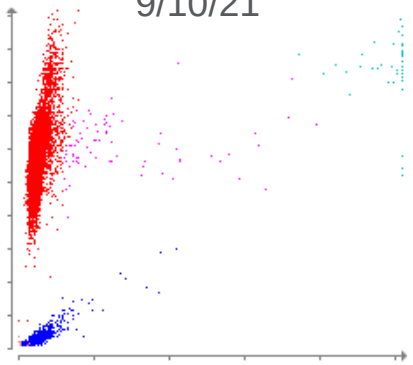
PLT的質量 ○ PCT 血小板總體積: 所有的血小板加起來的體積有多少?

透過數值的追蹤，可以看出血小板再生的狀況



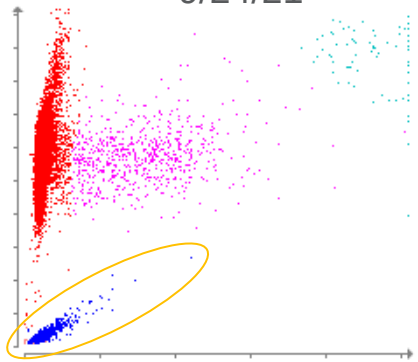
透過 ProCyte Dx 點狀圖觀察血小板的變化

9/10/21



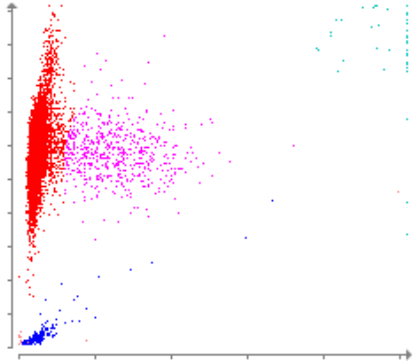
PLT= 309K
MPV=11.1

9/24/21



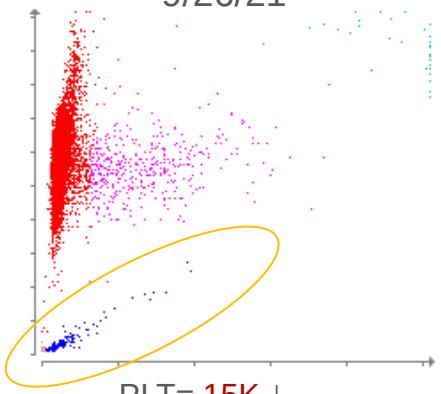
PLT= 237K
MPV=11.8

9/25/21



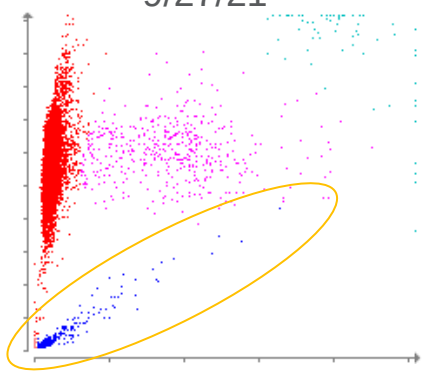
PLT= 21K ↓
MPV=12.0

9/26/21



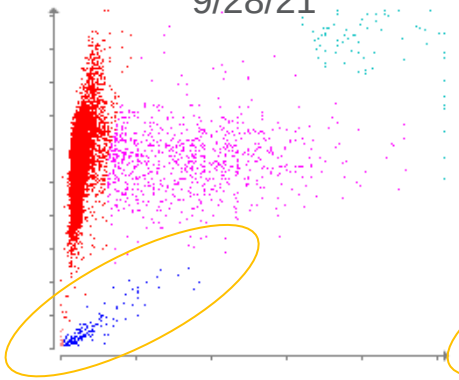
PLT= 15K ↓
MPV=12.5

9/27/21



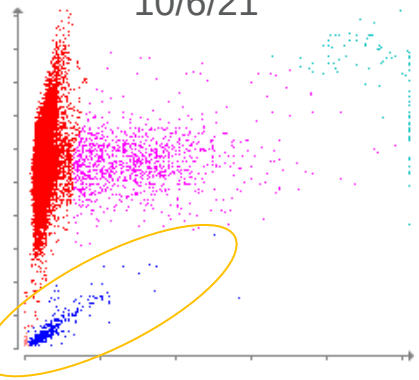
PLT= 22K ↓
MPV=14.8 ↑

9/28/21



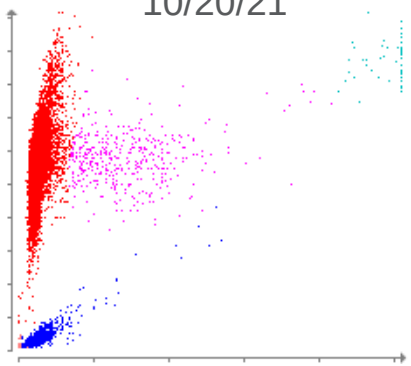
PLT= 15K ↓
MPV=15.9 ↑

10/6/21



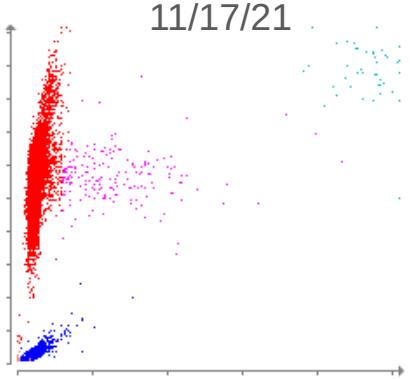
PLT= 48K ↓
MPV=15.9 ↑

10/20/21



PLT= 704K ↑
MPV=11.1

11/17/21



PLT= 434K
MPV=10.7

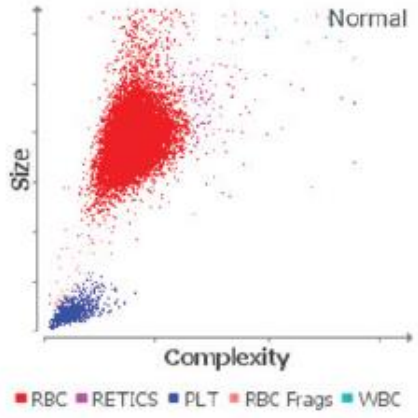
透過ProCyte One 點狀圖觀察血球變化

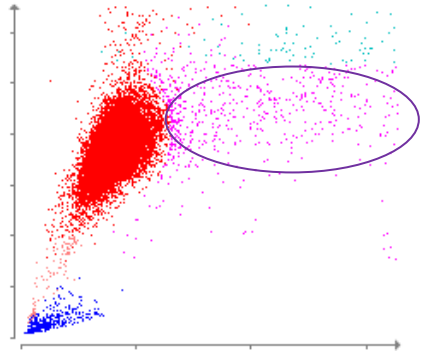
狗正常點狀圖

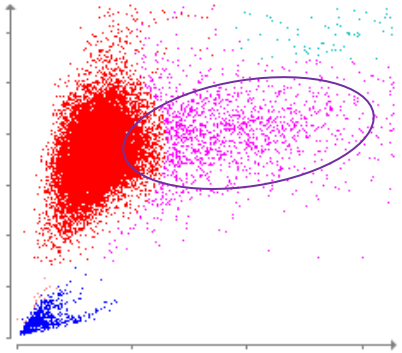
9/27/21

10/6/21

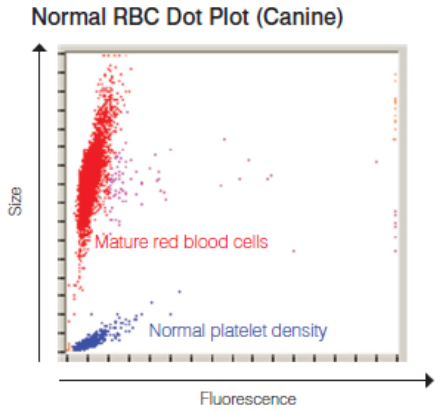
ProCyte One

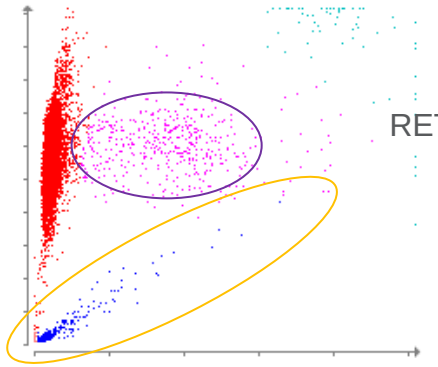






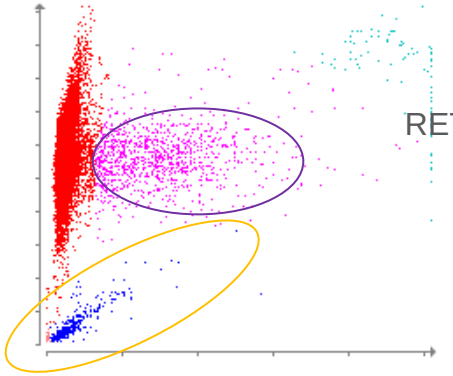
ProCyte Dx





RET= 91.3K

PLT= 22K ↓
MPV=14.8 ↑



RET= 229.9K ↑

PLT= 48K ↓
MPV=15.9 ↑

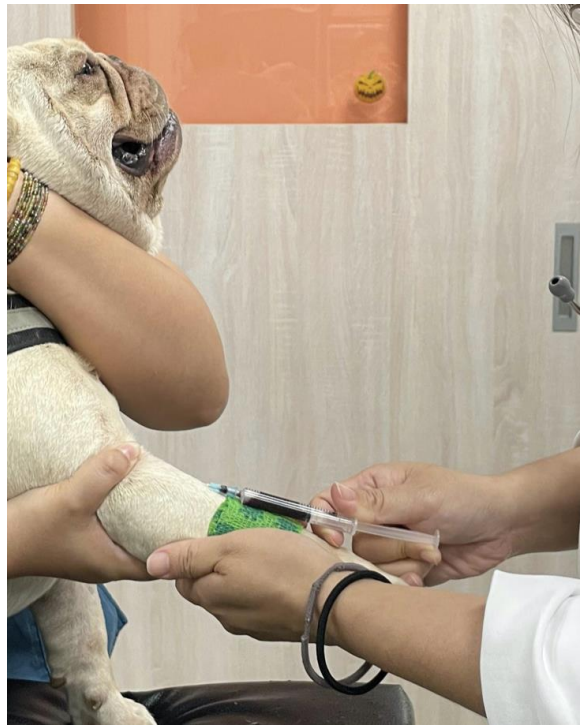
血小板低下要想到的問題

- **生成減少:** 骨髓問題? 自體免疫破壞前驅細胞?
- **消耗增加:** 出血、DIC
- **脾臟沉積:** 很活化的脾臟、脾臟腫瘤
- **破壞增加:** 很活化的脾臟/肝臟Macrophage、感染、免疫旺盛、髓外造血旺盛

https://eclinpath.com/hemostasis/disorders/platelet-numbers/

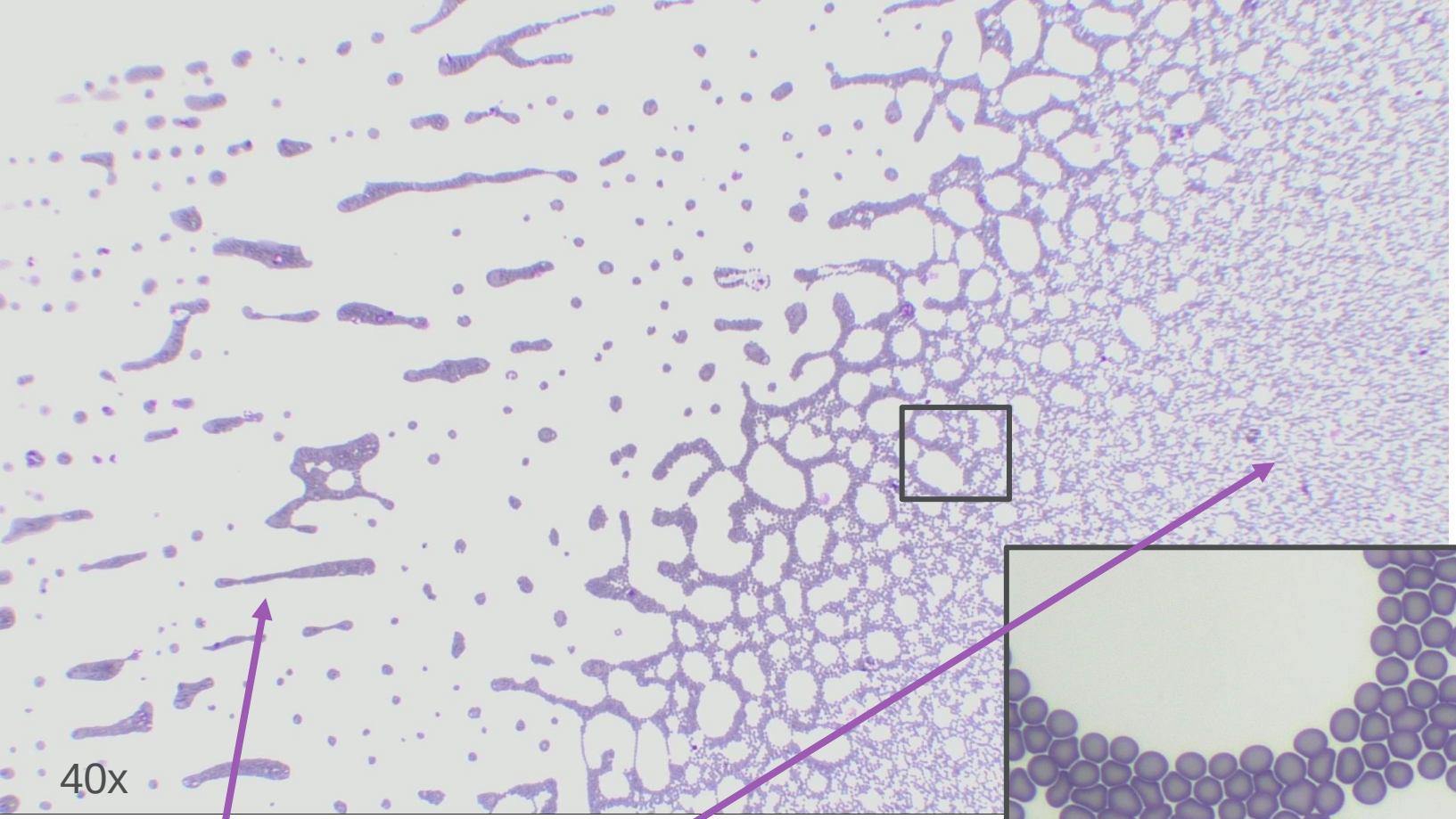
講到血小板..不得不說到抽血這件事

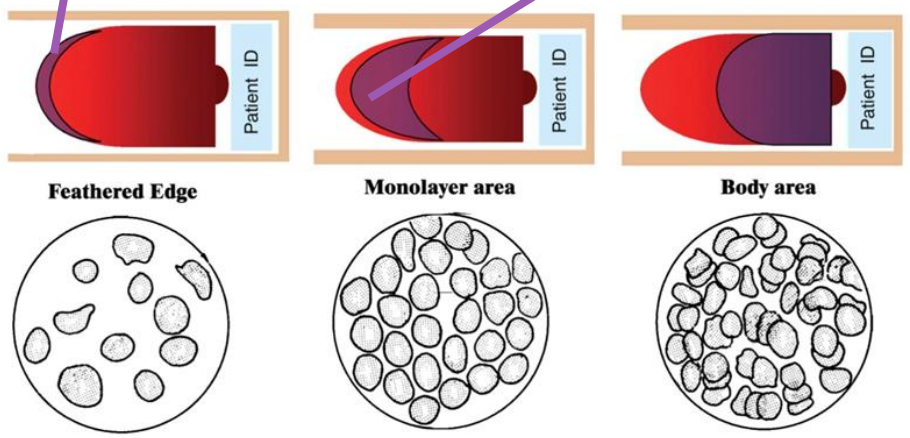
- 抽血的品質：讓血液滾滾的流動！頸靜脈抽血
- 抗凝的條件：（純）紫頭管 太多沒有救
- 混合均勻：貓咪認真搖
- 一定要看血液抹片!!!
- 良好的檢體，機器才會好好運轉
- 才會有好的報告，好的判讀

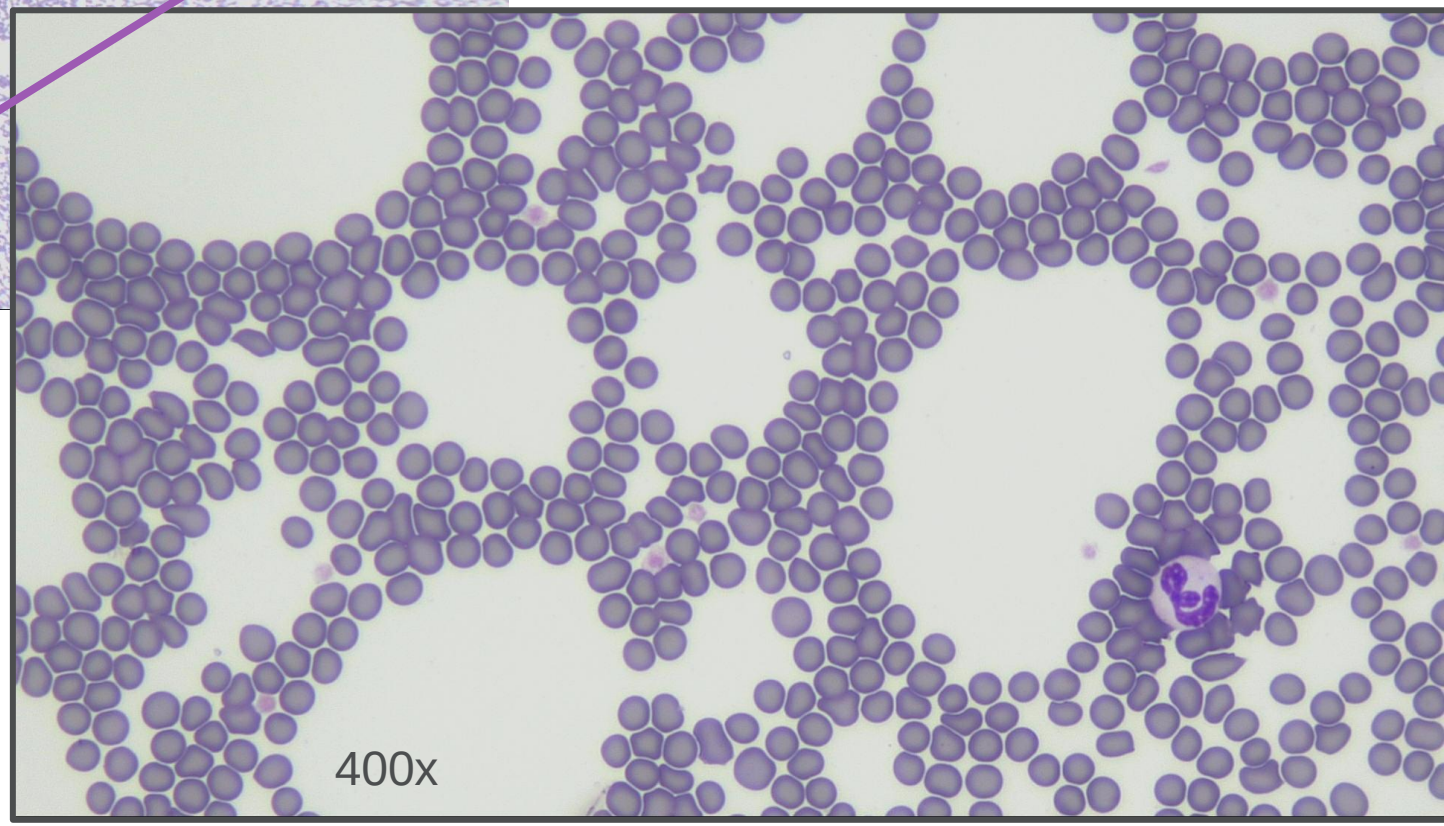


理想的血液抹片分布

一隻貓的血液抹片

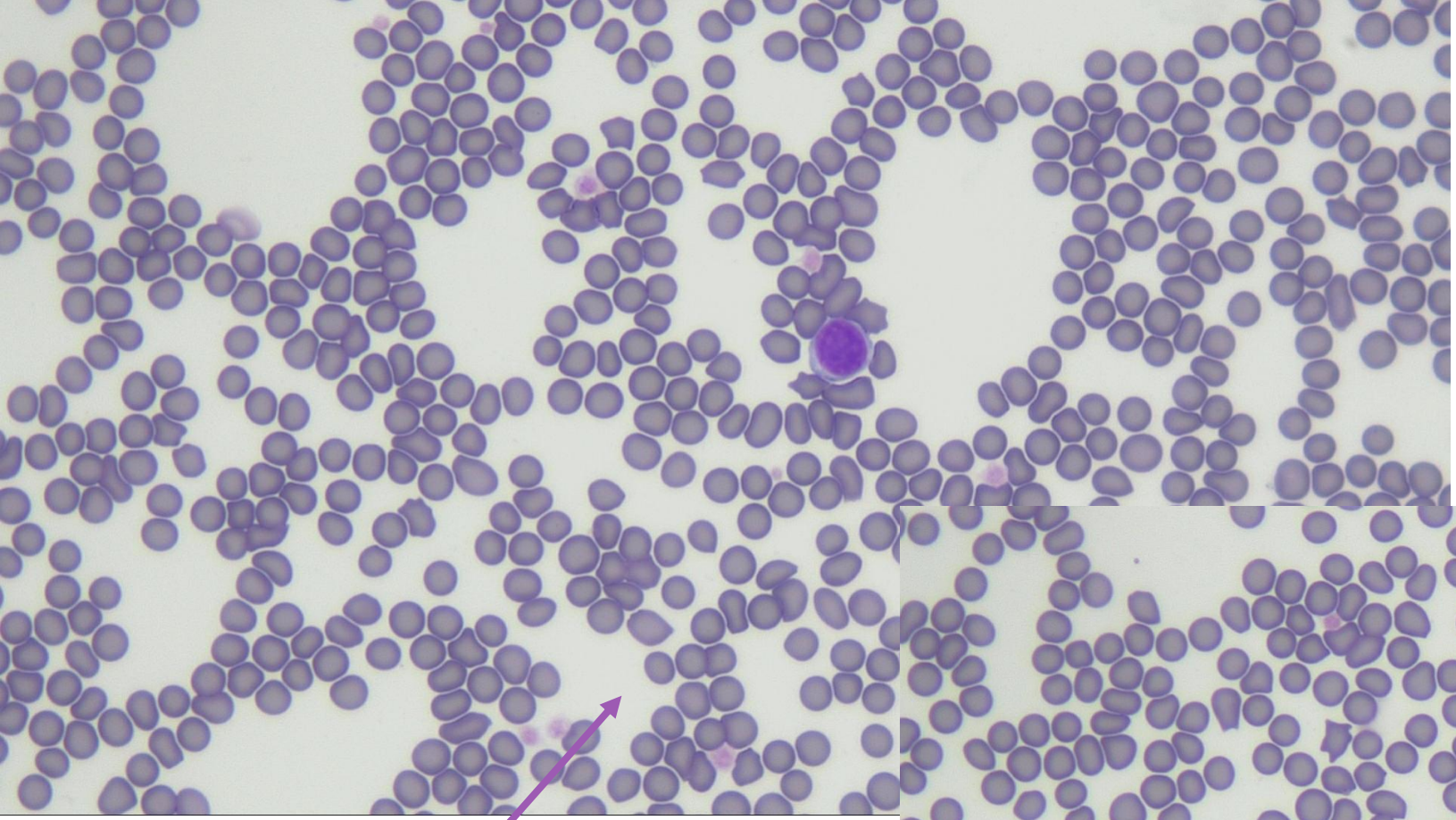


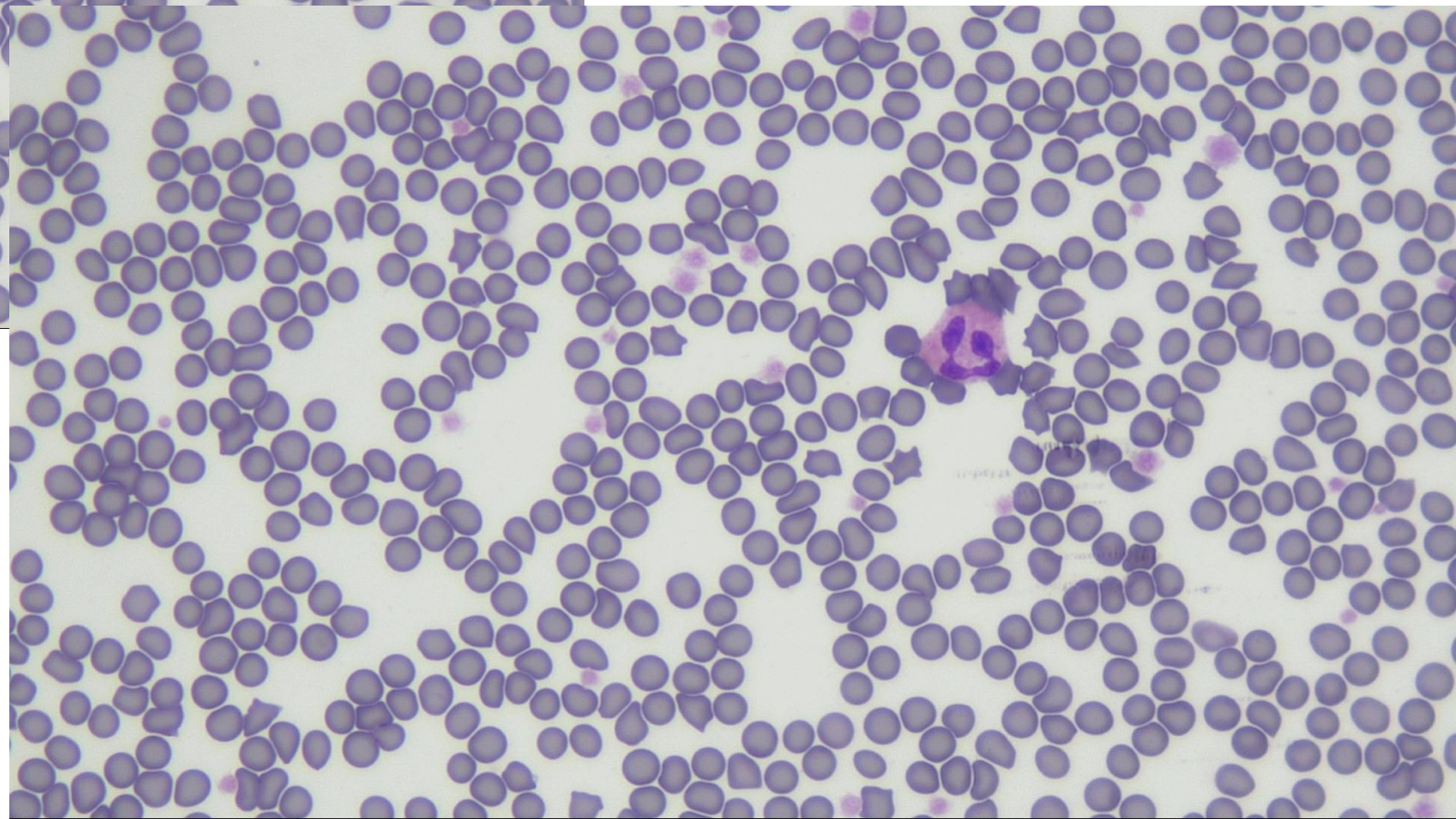


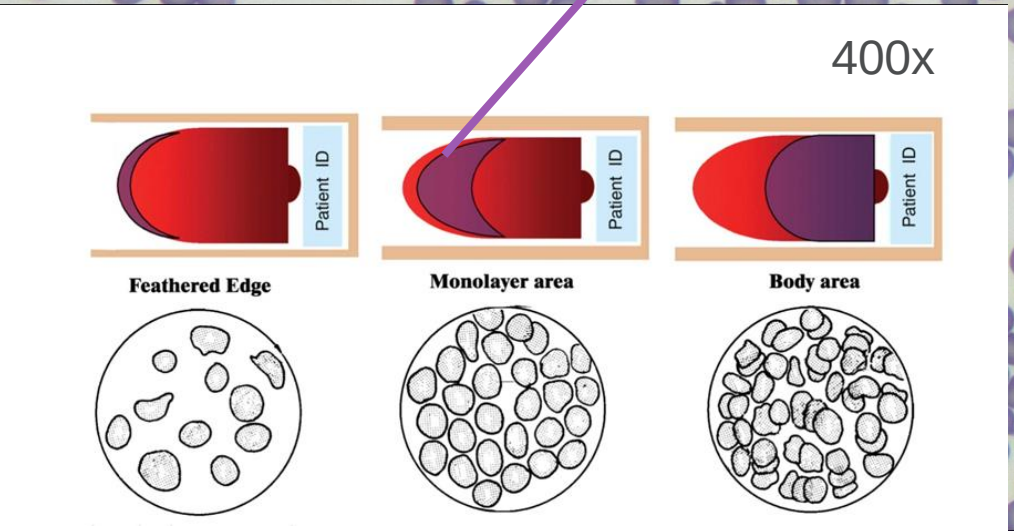


理想的血小板分布

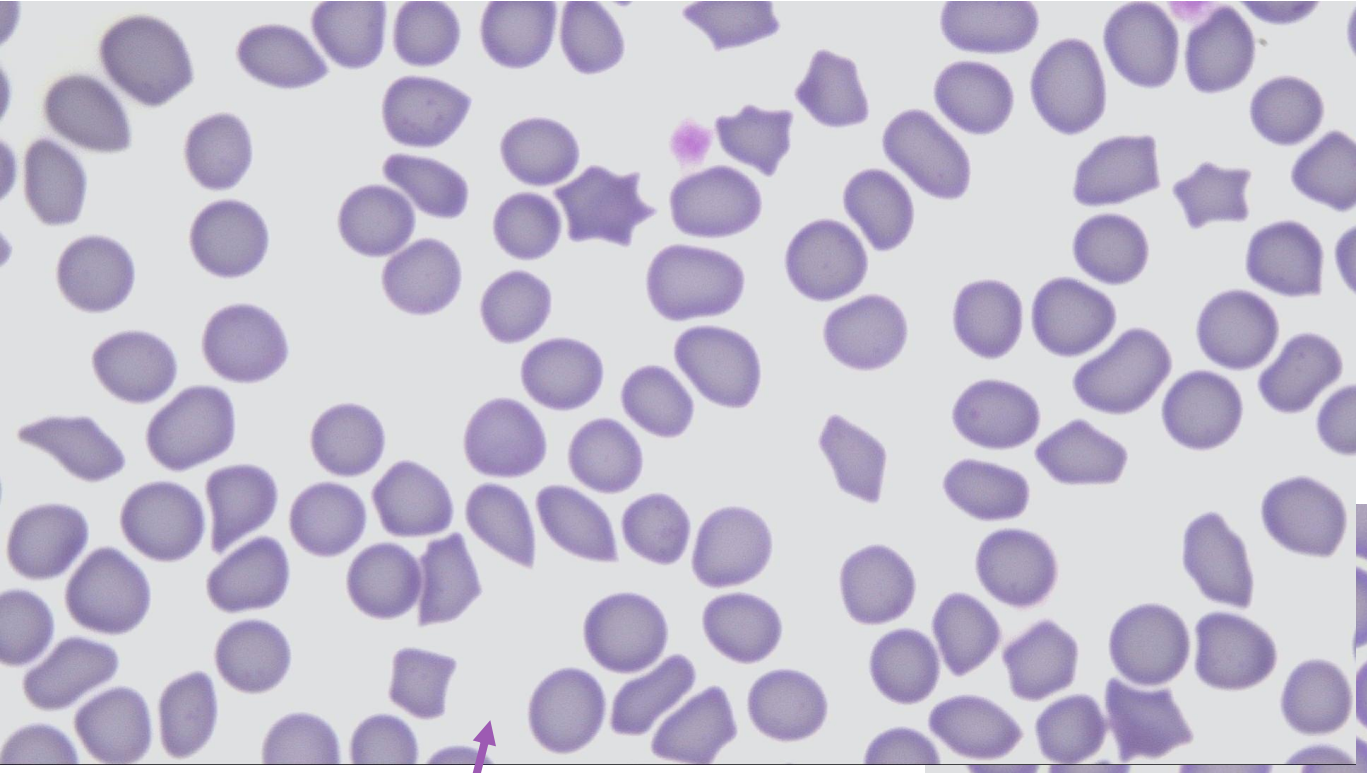
一隻貓的血液抹片



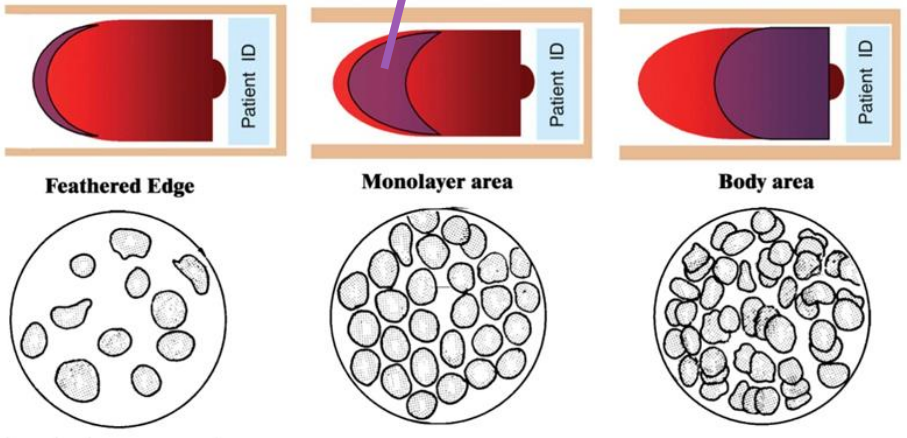




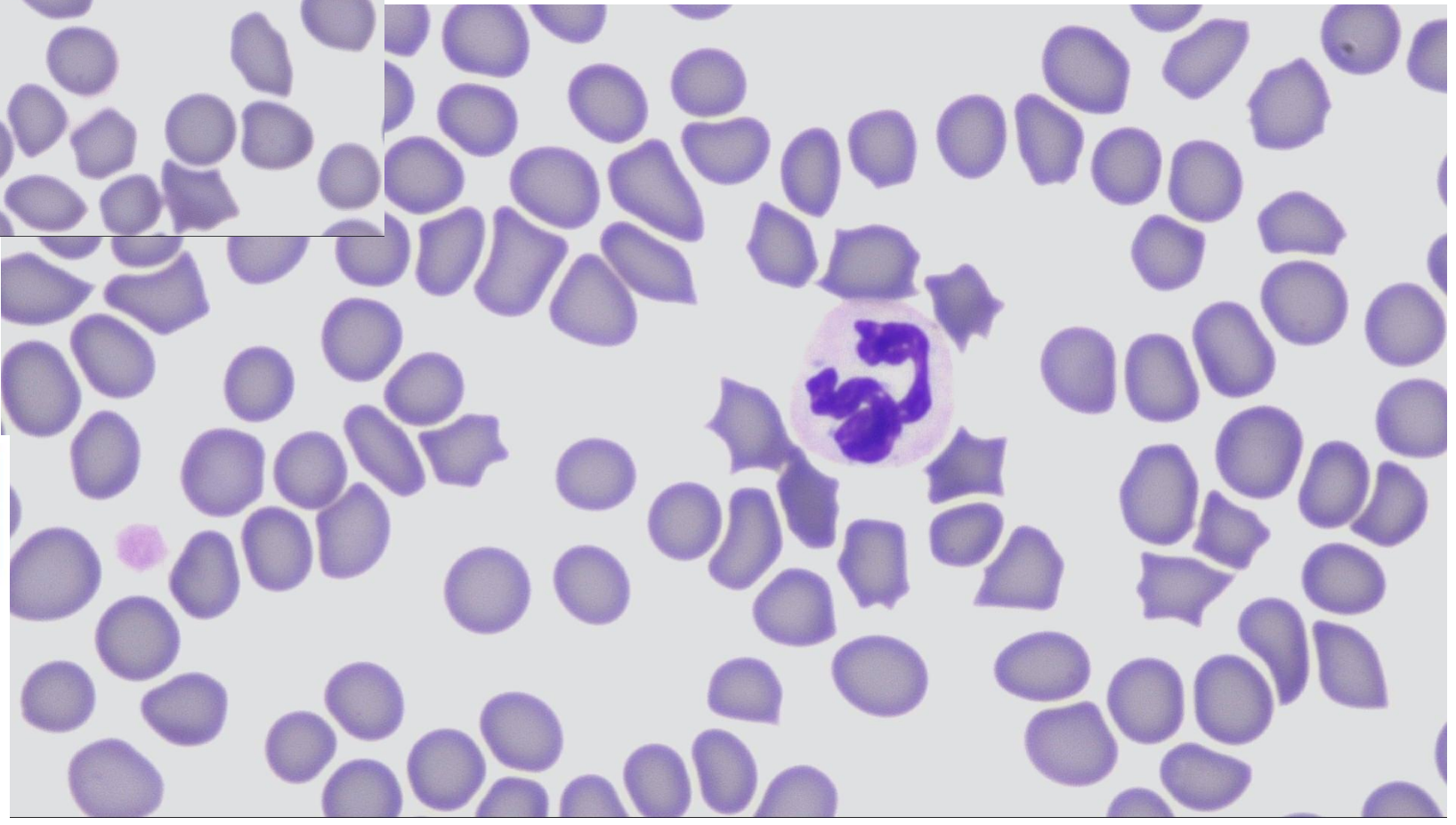
理想的血小板分布



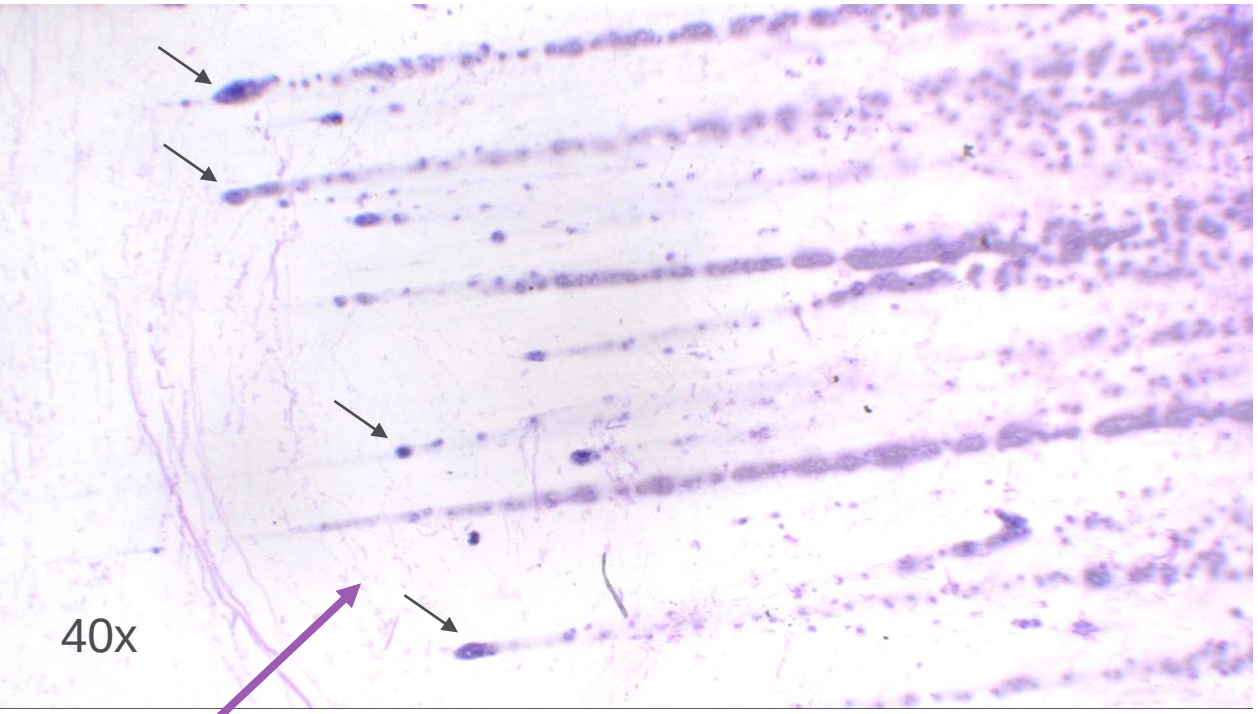
1000x

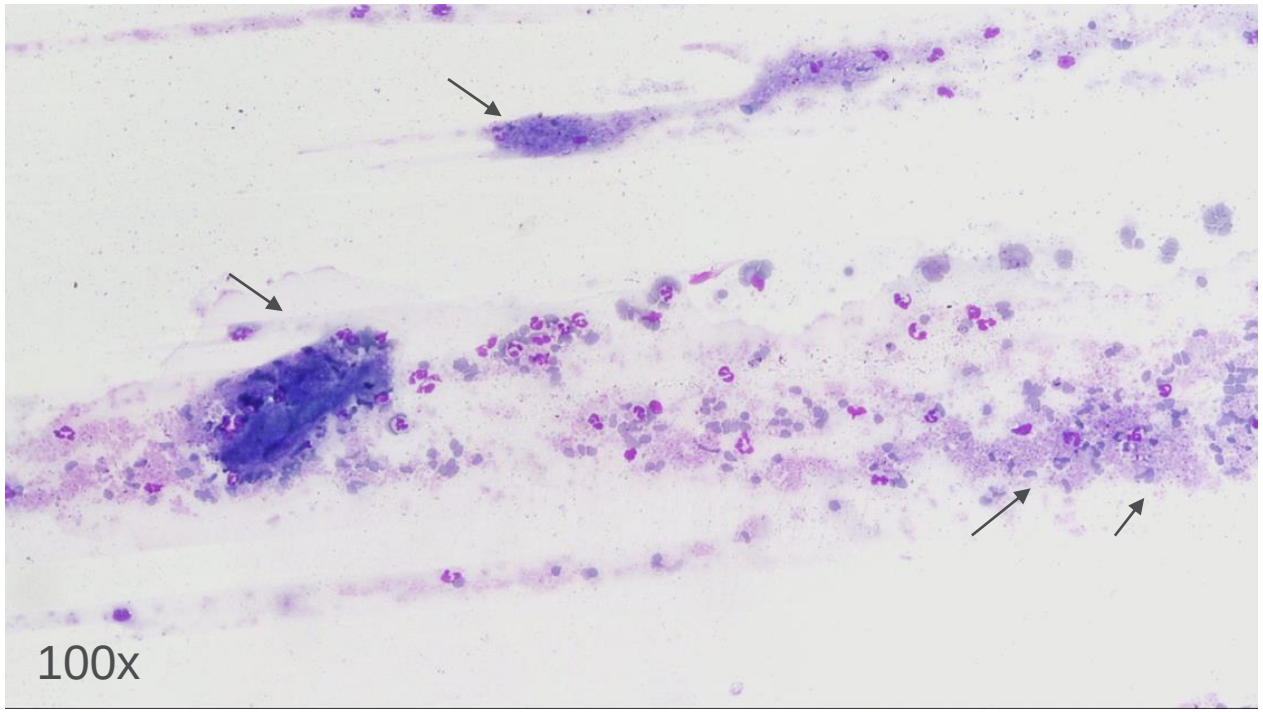


一隻貓的血液抹片

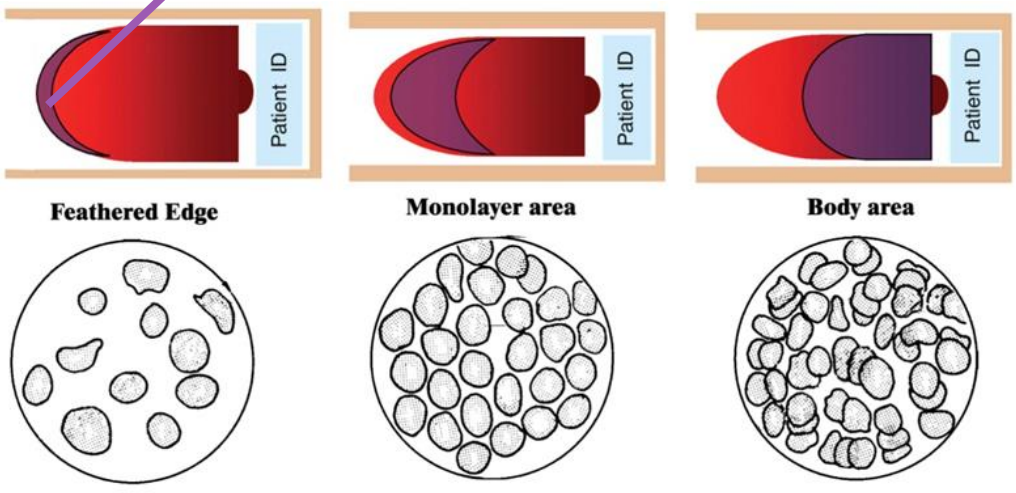


為什麼要看血液抹片?? (血小板凝集時..)

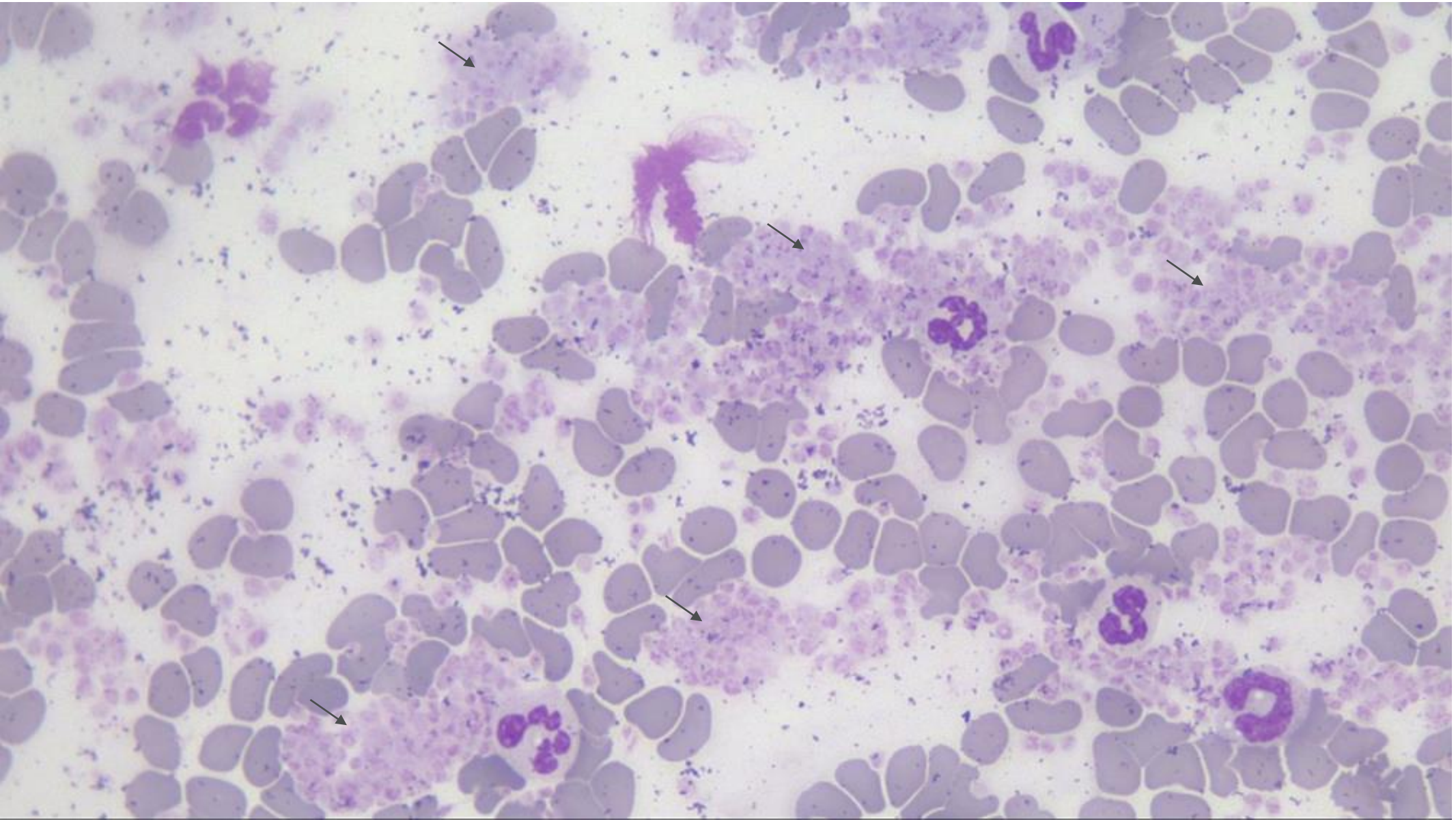




一隻狗的血液抹片



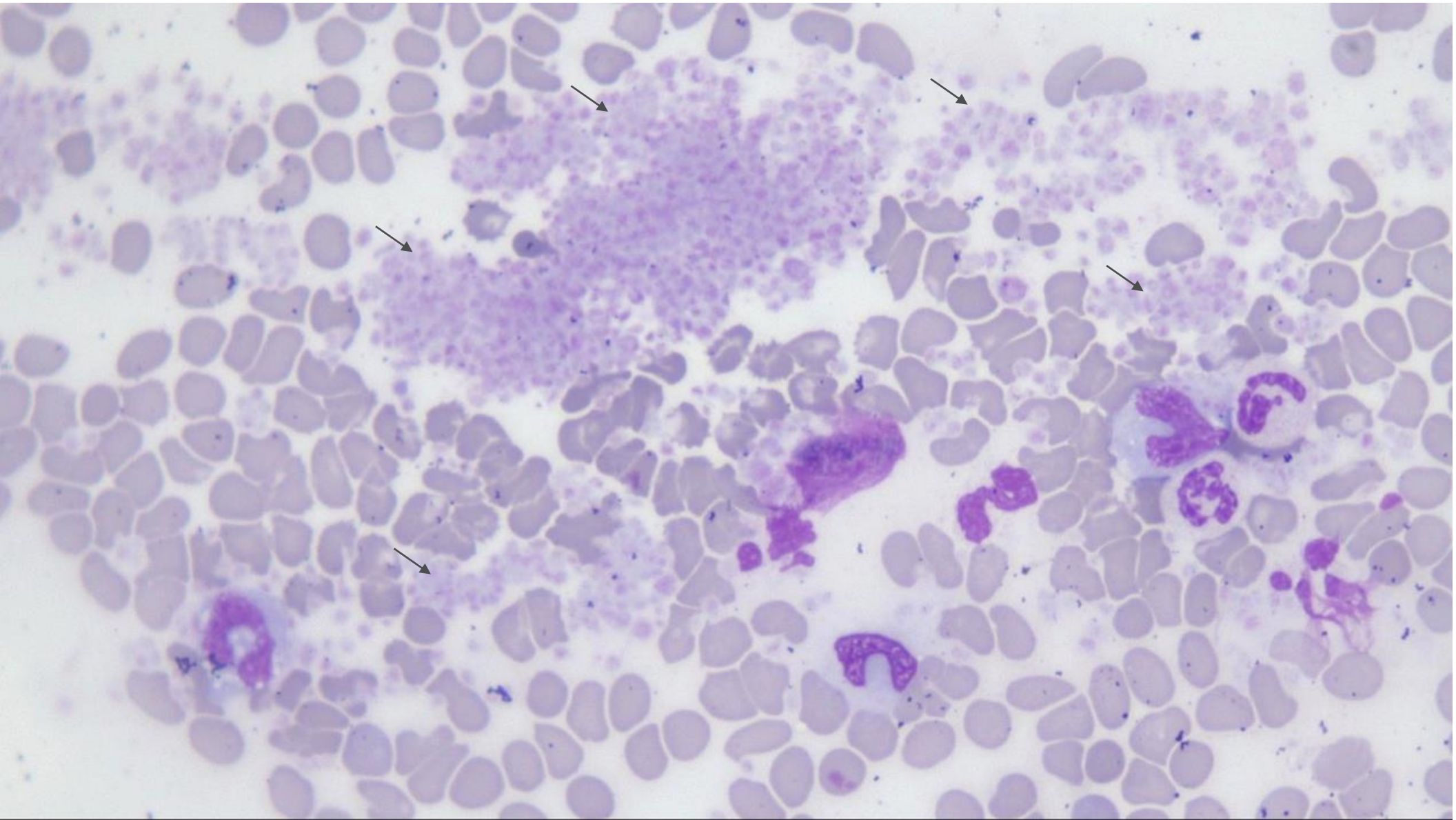
為什麼要看血液抹片?? (血小板凝集時..)



一隻狗的血液抹片

400x

為什麼要看血液抹片?? (血小板凝集時..)

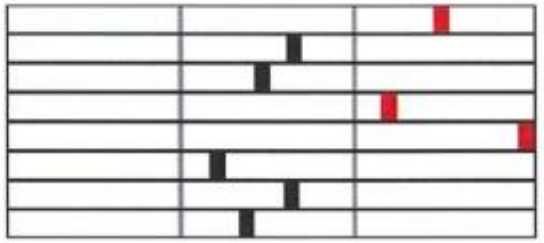


一隻狗的血液抹片

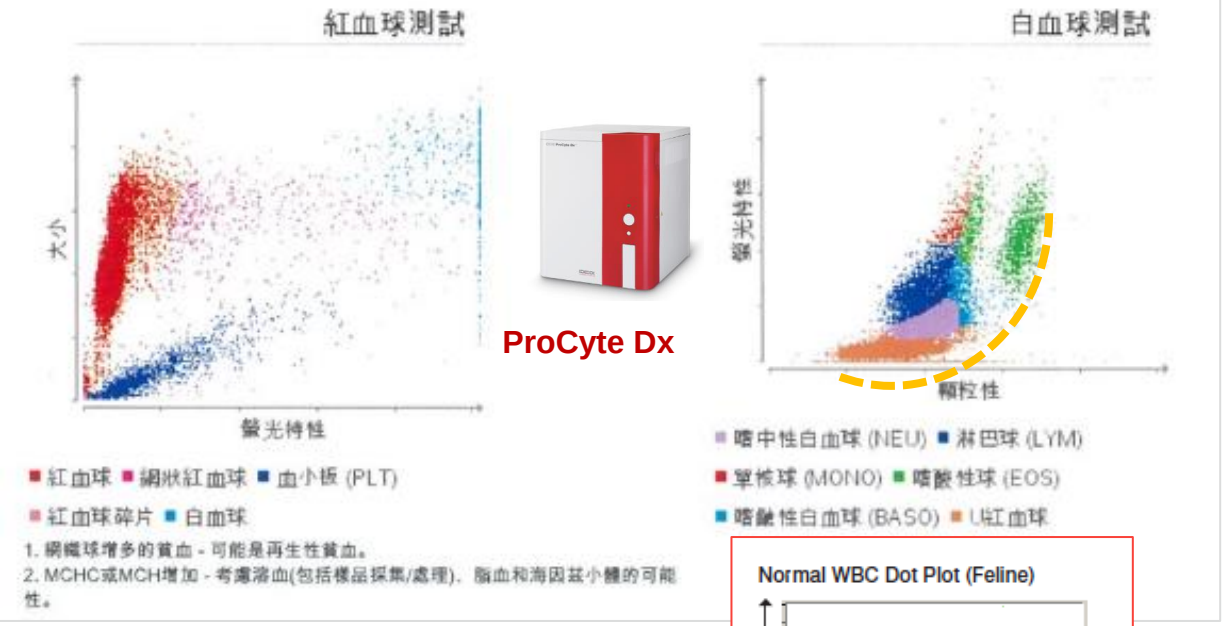
400x

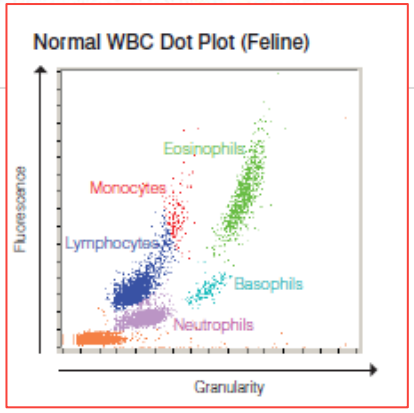
如何從點狀圖了解 血小板凝集?

%BASO	* 3.9 %		
NEU	* 22.51 K/µL	2.30 - 10.29	高
LYM	* 4.88 K/µL	0.92 - 6.88	
MONO	0.35 K/µL	0.05 - 0.67	
EOS	2.43 K/µL	0.17 - 1.57	高
BASO	* 1.22 K/µL	0.01 - 0.26	高
PLT	247 K/µL	151 - 600	
MPV	17.9 fL	11.4 - 21.6	
PCT	0.44 %	0.17 - 0.86	

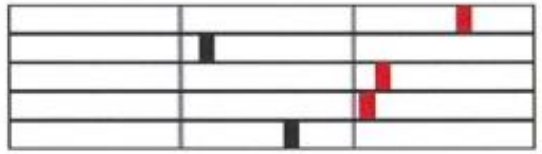


*請用點狀圖和（或）血液抹片再次確認。

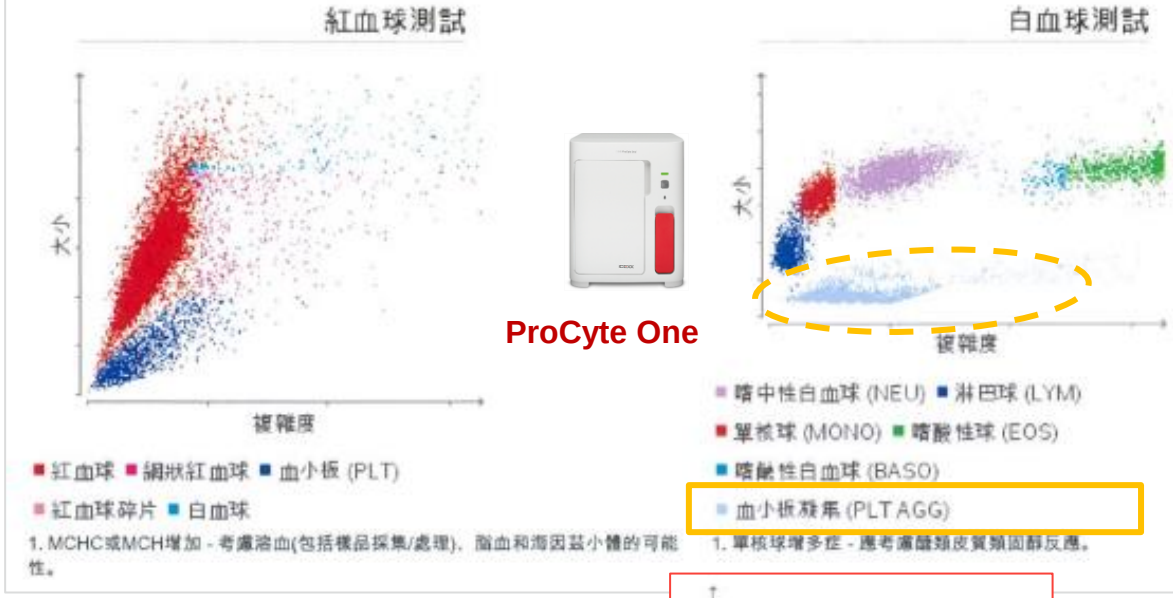




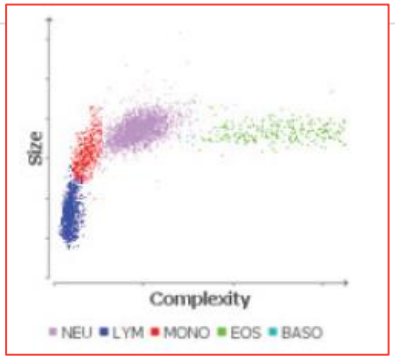
%BASO	0.5 %		
NEU	25.70 K/µL	2.30 - 10.29	高
LYM	1.89 K/µL	0.92 - 6.88	
MONO	1.25 K/µL	0.05 - 0.67	高
EOS	1.95 K/µL	0.17 - 1.57	高
BASO	0.17 K/µL	0.01 - 0.26	
PLT	--.-- K/µL	151 - 600	
MPV	--.-- fL	11.4 - 21.6	
PCT	--.-- %	0.17 - 0.86	



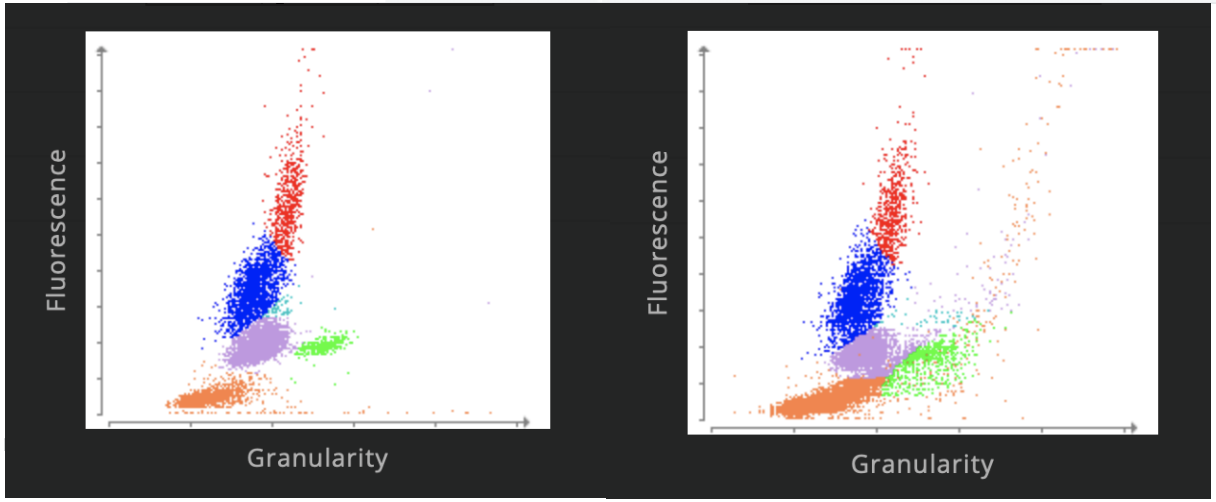
Platelet aggregates are detected. Platelet count may be higher than reported.



左右為同一隻貓同一檢體的血檢報告



WBC	11.08	*12.17	5.05 - 16.76 K/µL	
% Neutrophils	70.9	*67.5	%	
% Lymphocytes	18.8	*20.1	%	
% Monocytes	6.4	*5.6	%	
% Eosinophils	3.3	*6.4	%	
% Basophils	0.6	*0.4	%	
Neutrophils	7.85	*8.21	2.95 - 11.64 K/µL	
Lymphocytes	2.08	*2.45	1.05 - 5.10 K/µL	
Monocytes	0.71	*0.68	0.16 - 1.12 K/µL	
Eosinophils	0.37	*0.78	0.06 - 1.23 K/µL	
Basophils	0.07	*0.05	0.00 - 0.10 K/µL	
Platelets	**525**	*194	148 - 484 K/µL	
PDW	11.0	*13.2	9.1 - 19.4 fL	
MPV	11.6	*12.9	8.7 - 13.2 fL	
Plateletcrit	**0.61**	*0.25	0.14 - 0.46 %	



難怪最近血小板才多了起來
原來抽得好不好這麼重要

#3 巧口 的故事

巧口

- 11y/o MN poodle
- 6kg, BCS:8/9

- 骨刺 復健
- 瓣膜性心臟病，庫欣氏症

Endocrinology	6/12/20 1:09 PM	12:04 PM
Click to view Differentials		
Cortisol - Baseline	3.3	µg/dL
Cortisol Post-ACTH (Cushings selected)	>30.0	µg/dL

- 蛋白尿，高血壓

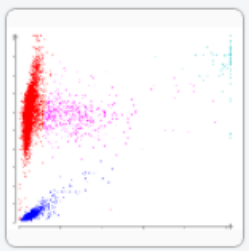
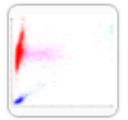
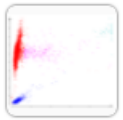
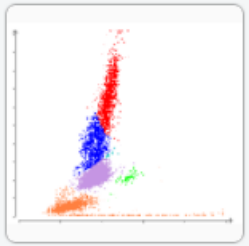
- Pimobendan
- Trilostane (1-4.56mg/kg bid)
- Enalapril

Endocrinology	8/31/21 5:35 PM	7/15/21 5:00 PM	5/11/21 4:50 PM	3/30/21 7:13 PM	12/23/20 5:13 PM	10/16/20 6:21 PM	9/7/20 7:19 PM	7/22/20 5:53 PM	
Cortisol Therapeutic Monitoring (High Range)	9.8	10.4	13.7	15.8	17.8	11.9	19.5	13.2	µg/dL

Hematology

Click to view Differentials

	3/30/21 5:11 PM		12/23/20 3:20 PM	7/22/20 4:31 PM
RBC	6.80	5.65 - 8.87 M/µL	7.35	6.83
Hematocrit	46.6	37.3 - 61.7 %	49.7	46.6
Hemoglobin	15.6	13.1 - 20.5 g/dL	16.6	16.1
MCV	68.5	61.6 - 73.5 fL	67.6	68.2
MCH	22.9	21.2 - 25.9 pg	22.6	23.6
MCHC	33.5	32.0 - 37.9 g/dL	33.4	34.5
RDW	18.7	13.6 - 21.7 %	19.0	18.2
% Reticulocyte	2.2	%	2.3	1.5
Reticulocytes	**149.6**	10.0 - 110.0 K/µL	**172.0**	103.8
Reticulocyte Hemoglobin	24.2	22.3 - 29.6 pg	25.1	26.2
WBC	**17.64**	5.05 - 16.76 K/µL	15.14	**17.11**
% Neutrophils	78.3	%	77.9	72.9
% Lymphocytes	9.9	%	10.2	10.2
% Monocytes	11.1	%	10.8	15.7
% Eosinophils	0.6	%	1.1	1.1
% Basophils	0.1	%	0.0	0.1
Neutrophils	**13.81**	2.95 - 11.64 K/µL	**11.79**	**12.48**
Lymphocytes	1.74	1.05 - 5.10 K/µL	1.55	1.74
Monocytes	**1.96**	0.16 - 1.12 K/µL	**1.64**	**2.69**
Eosinophils	0.11	0.06 - 1.23 K/µL	0.16	0.19
Basophils	0.02	0.00 - 0.10 K/µL	0.00	0.01
Platelets	**549**	148 - 484 K/µL	**551**	435
PDW	11.6	9.1 - 19.4 fL	10.1	11.3
MPV	12.4	8.7 - 13.2 fL	11.9	11.9
Plateletcrit	**0.68**	0.14 - 0.46 %	**0.66**	**0.52**

Chemistry

Click to view Differentials

	3/30/21 5:17 PM		12/23/20 3:29 PM	7/22/20 4:38 PM
Creatinine	0.4	0.5 - 1.8 mg/dL	0.3	0.6
BUN	22	7 - 27 mg/dL	8	35
BUN: Creatinine Ratio	61		30	55
ALT	68	10 - 125 U/L	60	122
AST	33	0 - 50 U/L	29	35
ALP	805	23 - 212 U/L	555	1,209

Endocrinology

	3/30/21 7:13 PM		12/23/20 5:13 PM	10/16/20 6:21 PM	9/7/20 7:19 PM	7/22/20 5:53 PM
Cortisol Therapeutic Monitoring (High Range)	15.8	µg/dL	17.8	11.9	19.5	13.2

治療監測（尚範圍）
Lysodren® (Mitotane 錠劑，USP) 使用後：
< 1 µg/dL - 考慮調整劑量。 若有腎源性症狀出現，可能需要緊急腎療照護
1 - 5 µg/dL - 若動物情況穩定，則維持目前劑量
> 5 µg/dL - 依臨床症狀調整劑量

Vetoryl® (Trilostane):
< 1.8 µg/dL - 考慮調整劑量。 若有腎源性症狀出現，可能需要緊急腎療照護
1.8 - 7.2 µg/dL - 若動物情況穩定，則維持目前劑量
> 7.2 µg/dL - 依臨床症狀調整劑量

愛德士公司提供的臨床診斷與治療計畫是參照內科醫學文獻及獸醫建立的參考值為基準。 任何建議都不能直接做為臨床判讀的依據。 對於任一個藥物的治療或監控計畫，都必須詳閱說明書內標示的劑量，適應症，藥物作用及注意事項。

Lysodren 是 Bristol Myers Squibb Company 的商標

Vetoryl 是 Dechra Ltd 的商標

Chemistry

Click to view Differentials

	12/23/21 5:30 PM		9/23/21 7:53 PM	9/15/21 12:05 PM
Urine Creatinine	13	mg/dL	31	20
Urine Protein	>400	mg/dL	>400	>400
Urine Protein: Creatinine Ratio	>30.12		>12.85	>19.73

UPC 比率 - 尿蛋白濃度除以尿肌酸酐濃度 (UPRO / UCRE)

應依據疾病位置、蛋白尿持續性、以及氮血症的程度來評估檢測結果。

定位疾病區域：蛋白尿的病因可以是腎前性、腎因性或腎後性
腎前性：評估 本瘧氏(Bence Jones) 蛋白、肌紅素、血紅素
腎因性：評估氮血症的程度
腎後性：評估尿液殘渣以評估出血、發炎和感染

持續性：重複 3 次或更多次做的 UPC 比率評估，來決定蛋白尿的持續性，每次評估至少間隔>2週

評估：
非氮血症且無活性尿液殘渣（狗和貓）的持續性蛋白尿：
UPC <0.5--無明顯蛋白尿
UPC> - 0.5 <1.0--需要進一步監測
UPC> - 1.0 <2.0--蛋白尿
UPC >-2.0--顯注蛋白尿

氮血症的狗且無活性尿液殘渣（狗）的持續性蛋白尿：
UPC <0.5--無明顯蛋白尿
UPC >-0.5--顯注蛋白尿

氮血症貓且無活性尿液殘渣（貓）的持續性蛋白尿：
UPC <0.4--無明顯蛋白尿
UPC >-0.4--顯注蛋白尿

說明：在嚴重的慢性腎臟病案例中，UPC 比率可能降低。這是由於隨著血漿肌酸酐濃度的增加和腎臟的功能性單位數量逐漸減少，蛋白從尿中的流失也減少。

Urinalysis

Click to view Differentials

	12/23/21 5:16 PM	5:11 PM	9/23/21 7:46 PM	9/15/21 11:34 AM
Collection	Cystocentesis		Cystocentesis	Cystocentesis
Color	Pale Yellow		Pale Yellow	Pale Yellow
Clarity	Slightly Cloudy		Slightly Clou...	Slightly Clou...

血小板什麼時候增多??

ORIGINAL RESEARCH

Thrombocytosis: a retrospective study of 165 dogs

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Key Words
Hyperadrenocorticism, neoplasia, platelets, reactive thrombocytosis, thromboemoblism

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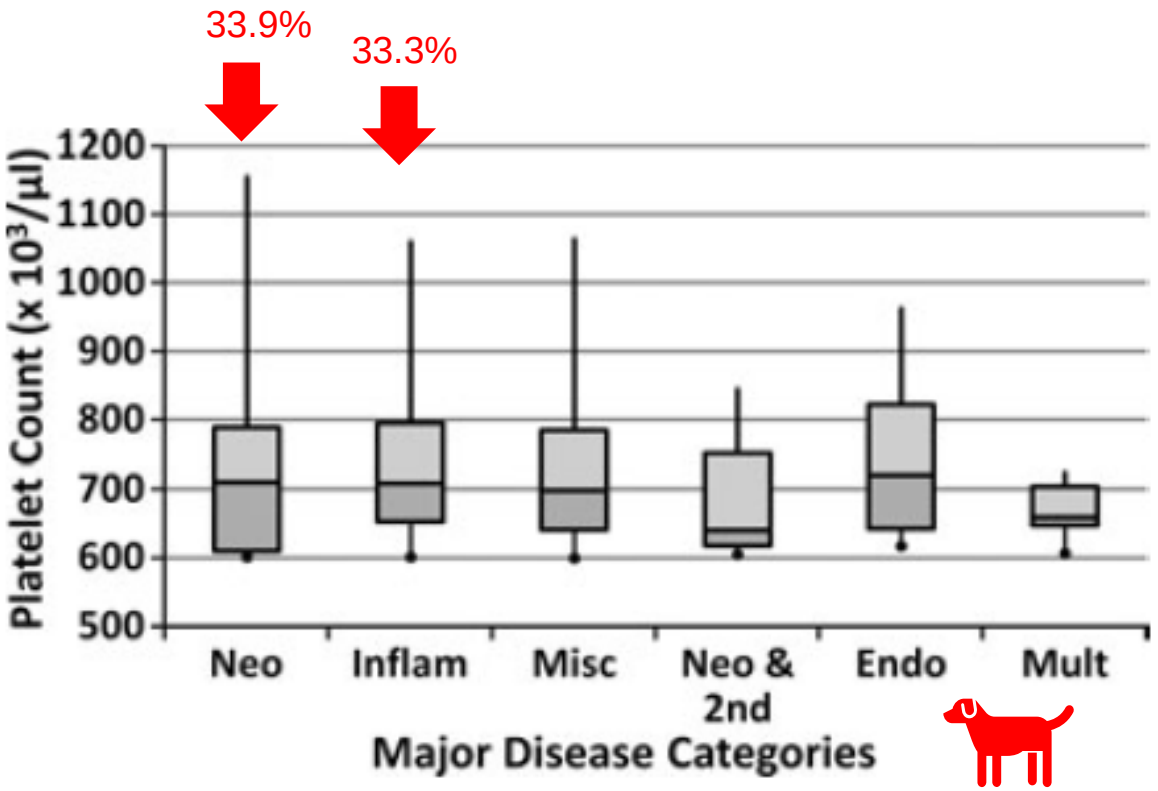
DOI:10.1111/j.1939-165X.2012.00416.x

Background: Thrombocytosis has been associated with various conditions, including inflammation, neoplasia, iron deficiency, splenectomy, and drug administration.
Objective: The aim of this study was to characterize diseases and conditions associated with thrombocytosis in dogs.
Methods: In this retrospective study, dogs with thrombocytosis (platelet count > 600 × 10^3/μL) and complete medical records during a 1-year period were included, and breed, sex, age, CBC results, alkaline phosphatase and gamma-glutamyltransferase activities in some dogs, administration of glucocorticoids or vincristine, and primary diagnosis were evaluated.
Results: Thrombocytosis was found in 240 of 5342 dogs (4.6%), and 165 (3.1%) met inclusion criteria. Thrombocytosis was secondary in all dogs, and underlying diseases and conditions (n,%) were neoplasia (56, 33.9%), inflammation (55, 33.3%), miscellaneous disorders (26, 15.8%), neoplasia plus a second disease (13, 7.9%), endocrine diseases (8, 4.8%), and multiple diseases (7, 4.2%). In dogs with neoplasia, carcinomas (24) and round cell neoplasms (20), especially lymphoma and mast cell tumor, were the most frequent tumors. Inflammatory disorders consisted of immune-mediated disorders (11), neurologic diseases (8), infectious diseases (6), allergic disease (5), orthopedic diseases (4), gastrointestinal diseases (4), and miscellaneous conditions (17). Of the 165 dogs, 73 (44.2%) had received glucocorticoids (55) or vincristine (18) Marked (850–969 × 10^3 platelets/μL) or extreme (≥ 970 × 10^3 platelets/μL) thrombocytosis occurred in 24 (14.5%) dogs; 12 (50.0%) had neoplasia. Thromboembolism occurred in 13 (7.9%) dogs.
Conclusions: Thrombocytosis in dogs occurred most frequently secondary to neoplastic and inflammatory diseases and was commonly associated with glucocorticoid and vincristine administration. Thromboembolic complications occurred in a small number of patients. Marked or extreme thrombocytosis was more likely to occur with neoplasia than with other conditions.

Vet Clin Pathol (2012)

- NCSU-VTH (2004 -2005)
- Thrombocytosis (platelet > 600K /uL)
- Thrombocytosis in 4.6% (240 / 5342) dogs
- 73 (44.2%) had received glucocorticoids (55) or vincristine (18).
- Marked /extreme thrombocytosis occurred in 24 (14.5%) dogs; 12 (50.0%) had neoplasia.
- Thromboembolism in 13 (7.9%) dogs.

觀察到的血小板增多之分類

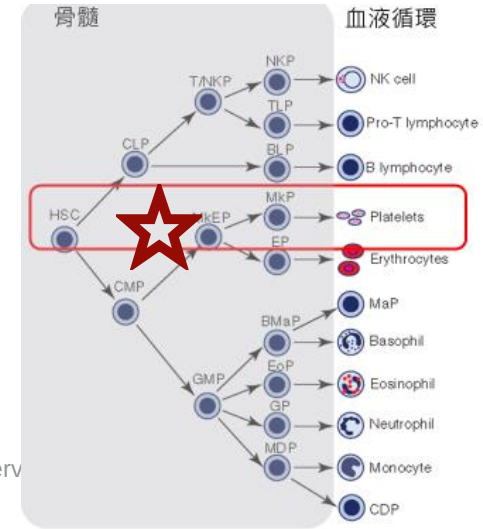


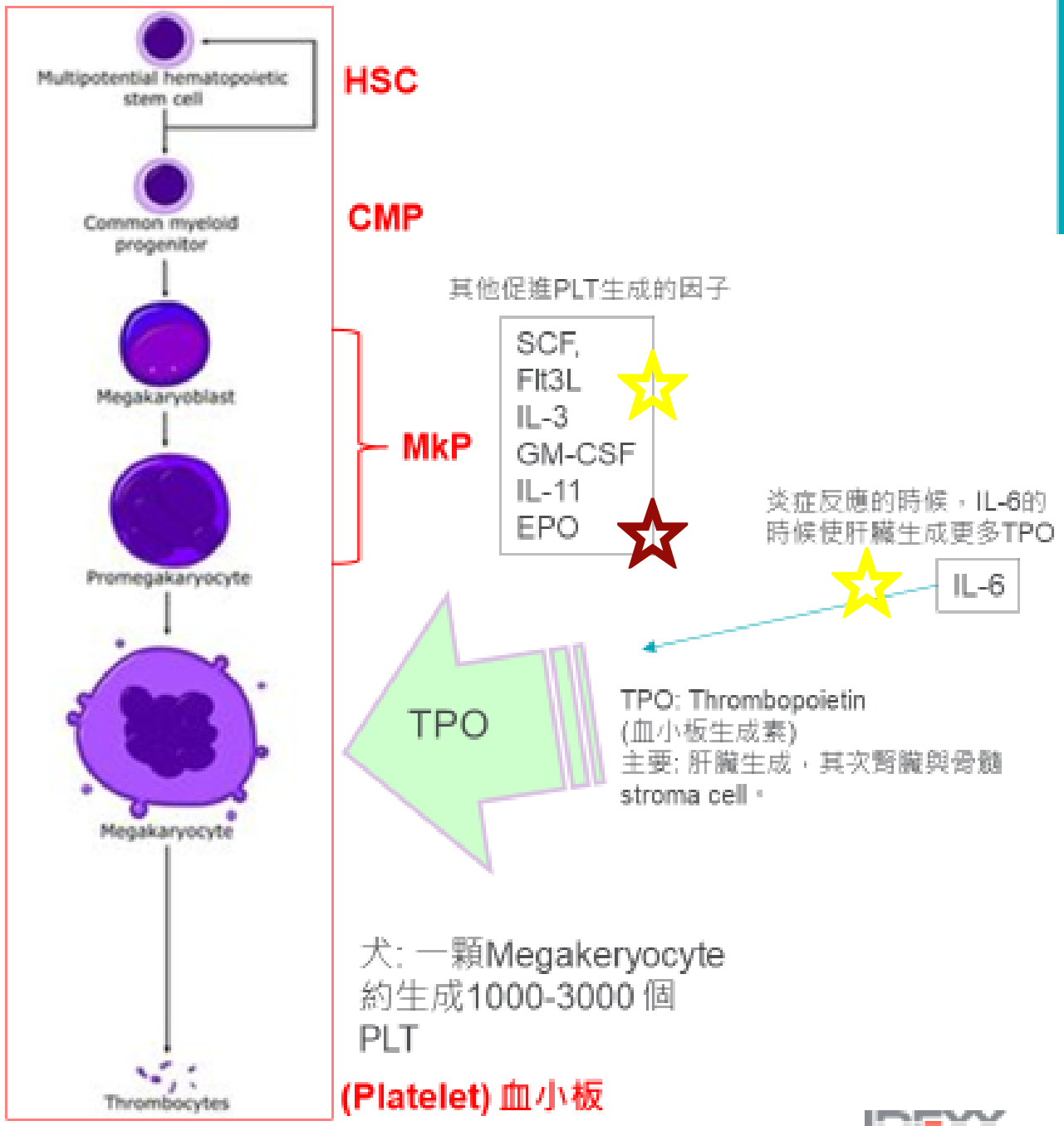
- Secondary Thrombocytosis.
- **Underlying diseases/conditions:**
  - neoplasia (56, 33.9%),
  - inflammation (55, 33.3%),
  - miscellaneous disorders (26, 15.8%),
  - Neoplasia+2nd disease (13, 7.9%),
  - endocrine diseases (8, 4.8%),
  - multiple diseases (7, 4.2%).
- **Neoplasia:**
  - carcinomas (24),
  - round cell neoplasms (20) (lymphoma, MCT)
- **Inflammation:**
  - Immune-mediated disorders (11),
  - neurologic diseases (8),
  - infectious diseases (6),
  - allergic disease (5),
  - orthopedic diseases (4),
  - gastrointestinal diseases (4),
  - miscellaneous conditions (17).
- **Endocrine:**
  - HAC (5)
  - DM (3)

JA Neel, et al. Thrombocytosis: a retrospective study of 165 dogs. Vet Clin Pathol 41/2 (2012) 216–222.

血小板增多的常見原因

- 炎症 ☆
- 腫瘤
- 缺鐵 ☆
- 脾臟摘除
- Cushing's Disease
- 用藥 (類固醇、vincristine)





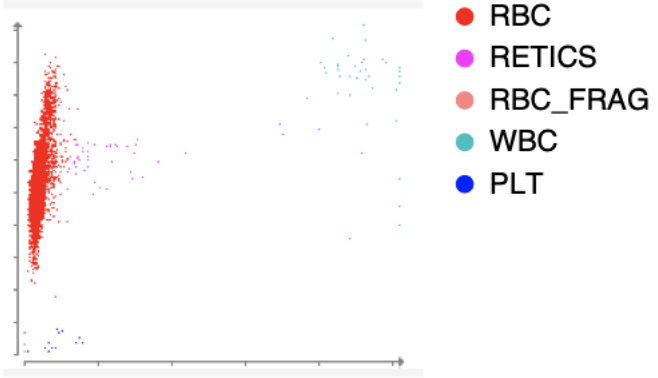
https://en.wikivet.net/Thrombopoiesis

#4 Amy 的故事

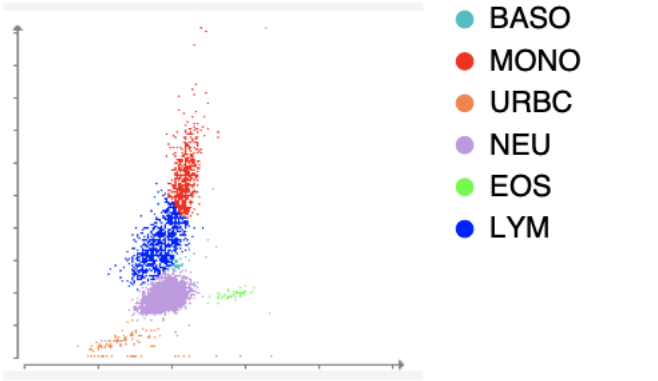
Amy

- 15y/o FS poodle 2.6kg
- 多喝多尿，食慾不好約二週，最近二天血尿
- 地方動物醫院診斷腎衰竭
- 轉診進一步治療
- 超音波掃瞄完 皮下出血嚴重

TEST	RESULT	REFERENCE VALUE	
RBC	7.97	5.65 - 8.87 M/µL	
Hematocrit	49.0	37.3 - 61.7 %	
Hemoglobin	17.0	13.1 - 20.5 g/dL	
MCV	**61.5**	**61.6 - 73.5 fL**	L
MCH	21.3	21.2 - 25.9 pg	
MCHC	34.7	32.0 - 37.9 g/dL	
RDW	19.2	13.6 - 21.7 %	
% Reticulocyte	0.2	%	
Reticulocytes	18.3	10.0 - 110.0 K/µL	
Reticulocyte Hemoglobin	25.2	22.3 - 29.6 pg	
WBC	10.07	5.05 - 16.76 K/µL	
% Neutrophils	81.3	%	
% Lymphocytes	10.1	%	
% Monocytes	7.9	%	
% Eosinophils	0.4	%	
% Basophils	0.3	%	
Neutrophils	8.18	2.95 - 11.64 K/µL	
Lymphocytes	**1.02**	**1.05 - 5.10 K/µL**	L
Monocytes	0.80	0.16 - 1.12 K/µL	
Eosinophils	**0.04**	**0.06 - 1.23 K/µL**	L
Basophils	0.03	0.00 - 0.10 K/µL	
Platelets	***0**	**148 - 484 K/µL**	L
PDW	- --.--	9.1 - 19.4 fL	
MPV	13.2	8.7 - 13.2 fL	
Plateletcrit	**0.00**	**0.14 - 0.46 %**	L



Download



TEST	RESULT	REFERENCE VALUE
Glucose	81	70 - 143 mg/dL
Creatinine	**7.5**	**0.5 - 1.8 mg/dL**
BUN	**152**	**7 - 27 mg/dL**
BUN: Creatinine Ratio	- --.--	
Phosphorus	**10.3**	**2.5 - 6.8 mg/dL**
Calcium	9.4	7.9 - 12.0 mg/dL
Sodium	149	144 - 160 mmol/L
Potassium	4.0	3.5 - 5.8 mmol/L
Na: K Ratio	37	
Chloride	114	109 - 122 mmol/L
Total Protein	6.1	5.2 - 8.2 g/dL
Albumin	2.9	2.2 - 3.9 g/dL

檢驗項目	物種-動物名	(編號) 檢體內容
嗜氧培養	犬-Amy	(1) 尿液 (地上盛接)

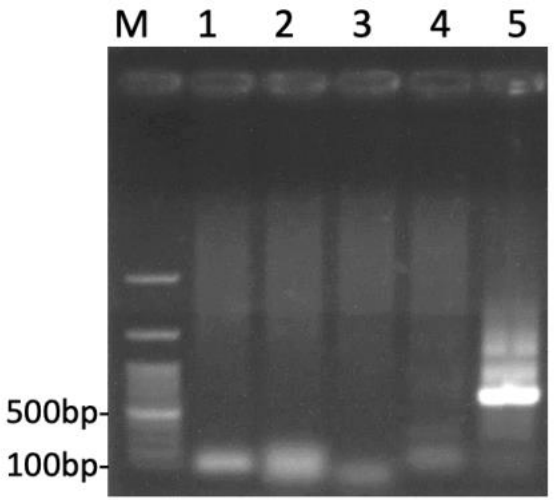
2. 細菌分離鑑定結果:

樣品	檢體抹片半定量	病原鑑定與半定量結果
(1)	未觀察到典型細菌細胞	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

TEST	RESULT
Collection	Table top
Color	Orange
Clarity	Cloudy
Specific Gravity	1.009
pH	6.5
Urine Protein	500
Glucose	neg
Ketones	neg
Blood / Hemoglobin	250
Bilirubin	neg
Urobilinogen	norm
Leukocyte Esterase	neg
White Blood Cells	6 /HPF
Red Blood Cells	>50 /HPF
Bacteria, Cocci	* None detected
Bacteria, Rods	* Suspect presence
Squamous Epithelial Cells	None detected
Non-Squamous Epithelial Cells	<1 /HPF

Babesia canis	陰性
Babesia gibsoni	陰性
Ehrlichia canis	陰性
Anaplasma platys	陰性
Mycoplasma 兩型	陰性



M: DNA ladder
1: *Babesia* spp.
2: *Ehrlichia canis*
3: *Anaplasma platys*
4: *Mycoplasma* spp.
5: PCR internal control

☐ ANA 陽性
☐ SS-A 陽性
☐ ANA titer:

■ ANA 陰性

■ direct Coombs test 陽性

- 溫抗體
- 低溫(cold reactive)抗體

☐ direct Coombs test 陰性

Hematology

Click to view Differentials

	2/10/22 7:35 AM	2/10/22 7:32 AM	2/9/22	2/9/22 10:12 AM	2/8/22 5:38 PM	2/7/22 8:26 PM
		ProCyte Dx Hematology Analyzer				
RBC	7.39	7.33	6.33	6.04	6.53	7.97
Hematocrit	45.8	48.3	37.6	37.3	40.1	49.0
Hemoglobin	17.1	16.0	14.4	**12.8**	13.7	17.0
MCV	62.0	65.9	**59.5**	61.8	**61.4**	**61.5**
MCH	23.1	21.8	22.8	21.2	**21.0**	21.3
MCHC	37.3	33.1	**38.3**	34.3	34.2	34.7
RDW	21.0	18.4	19.3	15.5	16.4	19.2
% Reticulocyte	0.2	0.1	0.1	0.0	0.1	0.2
Reticulocytes	11.8	**4.4**	**6.8**	**1.8**	**4.6**	18.3
Reticulocyte		**22.0**		25.4	22.8	25.2
Platelets	*37	*1	**25**	*0	*0	*0
PDW	*14.2	- --.--	16.7	- --.--	- --.--	- --.--
MPV	- --.--	**17.6**	- --.--	**14.8**	**17.0**	13.2
Plateletcrit	- --.--	**0.00**	- --.--	**0.00**	**0.00**	**0.00**

- cerenia, pantoprazole, ampicillin, 鋇劑
- Vincristine 雲南白藥（保險子）
- Prednisolone, methylprednisolone

- 持續嘔吐，血樣
- 癲癇

- 安樂

Chemistry Click to view Differentials	2/10/22 10:03 AM	2/10/22 7:39 AM	2/9/22 10:57 AM	2/9/22 10:22 AM	2/8/22 5:49 PM
Glucose					81
Creatinine		6.7		6.8	7.5
BUN	188	>130	149	>130	152
BUN: Creatinine Ratio					--.--
Phosphorus		14.6		9.9	10.3

Hematology (Click to view Differentials)	2/10/22 7:35 AM			2/10/22 7:32 AM	2/9/22 10:26 AM	2/9/22 10:12 AM	2/8/22 5:38 PM	2/7/22 8:26 PM
RBC	7.39	5.65 - 8.87 M/µL		7.33	6.33	6.04	6.53	7.97
Hematocrit	45.8	37.3 - 61.7 %		48.3	37.6	37.3	40.1	49.0
Hemoglobin	17.1	13.1 - 20.5 g/dL		16.0	14.4	12.8	13.7	17.0
MCV	62.0	61.6 - 73.5 fL		65.9	59.5	61.8	61.4	61.5
MCH	23.1	21.2 - 25.9 pg		21.8	22.8	21.2	21.0	21.3
MCHC	37.3	32.0 - 37.9 g/dL		33.1	38.3	34.3	34.2	34.7
RDW	21.0	13.6 - 21.7 %		18.4	19.3	15.5	16.4	19.2
% Reticulocyte	0.2	%		0.1	0.1	0.0	0.1	0.2
Reticulocytes	11.8	10.0 - 110.0 K/µL		4.4	6.8	1.8	4.6	18.3
Reticulocyte Hemoglobin				22.0		25.4	22.8	25.2
WBC	17.13	5.05 - 16.76 K/µL		14.12	10.24	8.70	6.76	10.07
% Neutrophils	*84.0	%		*83.5	82.6	83.1	78.2	81.3
% Lymphocytes	0.7	%		*5.0	2.2	6.9	10.9	10.1
% Monocytes	15.3	%		*11.5	15.1	9.7	9.6	7.9
% Eosinophils	0.0	%		0.0	0.1	0.1	1.0	0.4
% Basophils	0.0	%		0.0	0.0	0.2	0.3	0.3
Neutrophils	*14.39	2.95 - 11.64 K/µL		*11.79	8.45	7.23	5.28	8.18
Bands				*Suspected				
Lymphocytes	0.12	1.05 - 5.10 K/µL		*0.71	0.22	0.60	0.74	1.02
Monocytes	2.61	0.16 - 1.12 K/µL		*1.62	1.54	0.84	0.65	0.80
Eosinophils	0.00	0.06 - 1.23 K/µL		0.00	0.01	0.01	0.07	0.04
Basophils	0.01	0.00 - 0.10 K/µL		0.00	0.00	0.02	0.02	0.03
Platelets	*37	148 - 484 K/µL		*1	25	*0	*0	*0
PDW	*14.2	9.1 - 19.4 fL		- --.--	16.7	- --.--	- --.--	- --.--
MPV	- --.--	8.7 - 13.2 fL		17.6	- --.--	14.8	17.0	13.2
Plateletcrit	- --.--	0.14 - 0.46 %		0.00	- --.--	0.00	0.00	0.00
RBC Run								
WBC Run								

紅血球質量

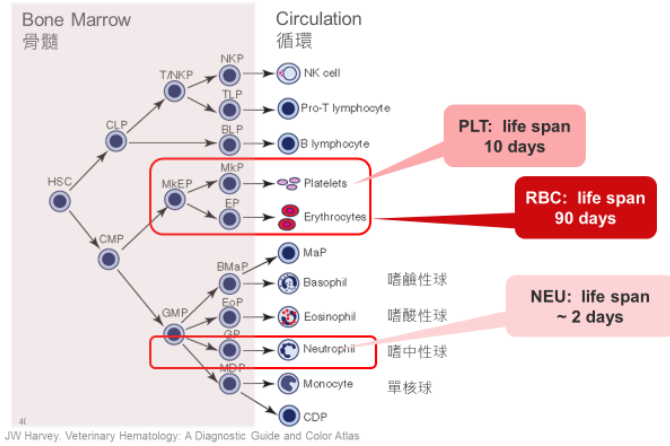
網織球數量/品質

嗜中性球數量

血小板質量/品質

RET減少....
- 炎症反應?
- 骨髓的問題?
- 腎臟損傷?
- 用藥?

細胞的生命週期反映出骨髓的狀態



JW Harvey. Veterinary Hematology: A Diagnostic Guide and Color Atlas

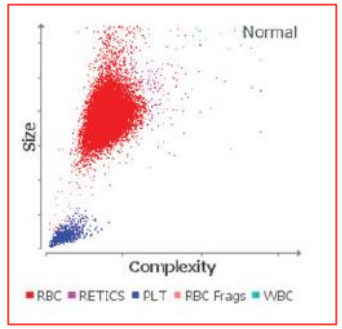
PLT質量持續低下....
- 數據是什麼意思?
- 到底有沒有改善?

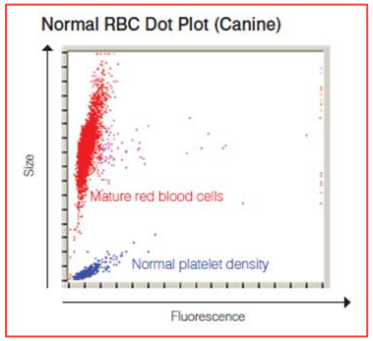
IDEXX

透過ProCyte Dx、ProCyte One點狀圖 觀察血球的變化

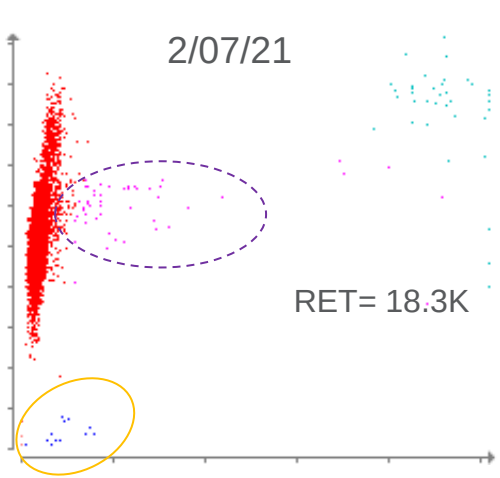
狗正常點狀圖

ProCyte One

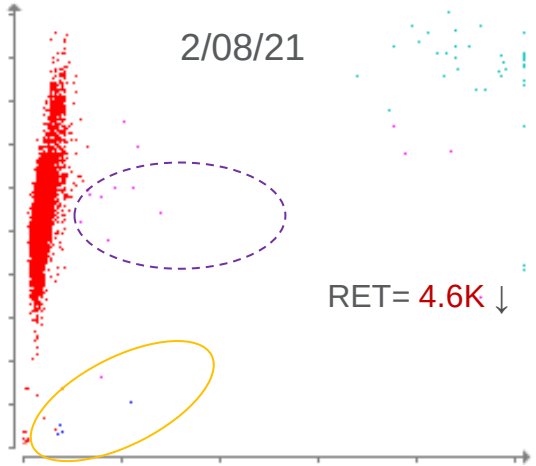




ProCyte Dx



PLT= *0 K ↓
PCT= 0.00 ↓
MPV=13.2



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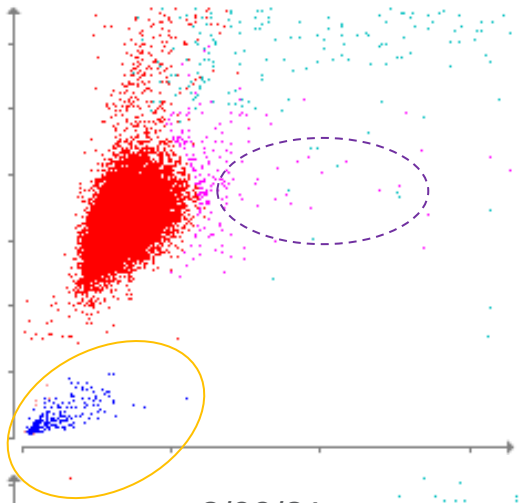
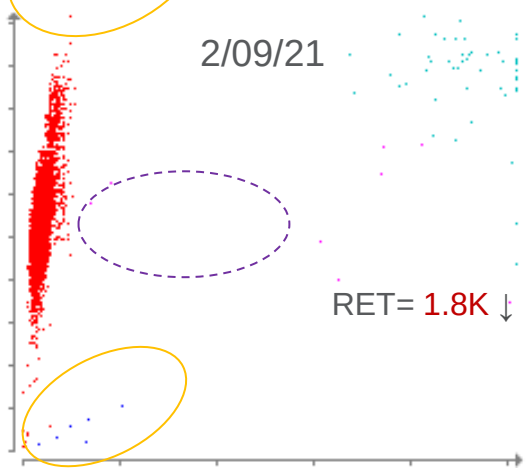
PCT= 0.00 ↓
MPV=17.0 ↑





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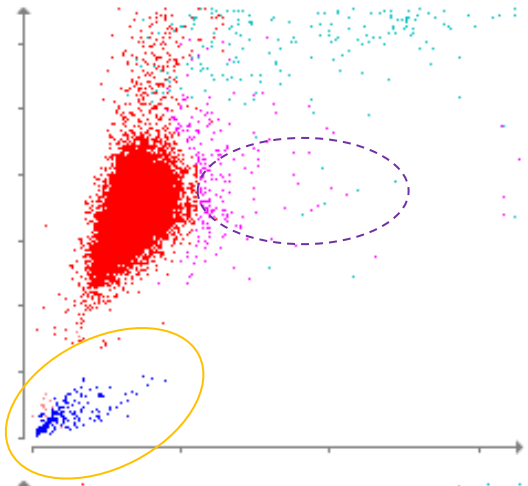
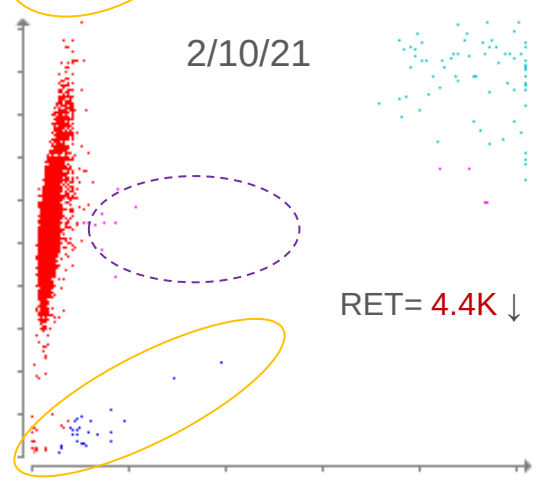
PCT= 0.00 ↓
MPV=14.8 ↑





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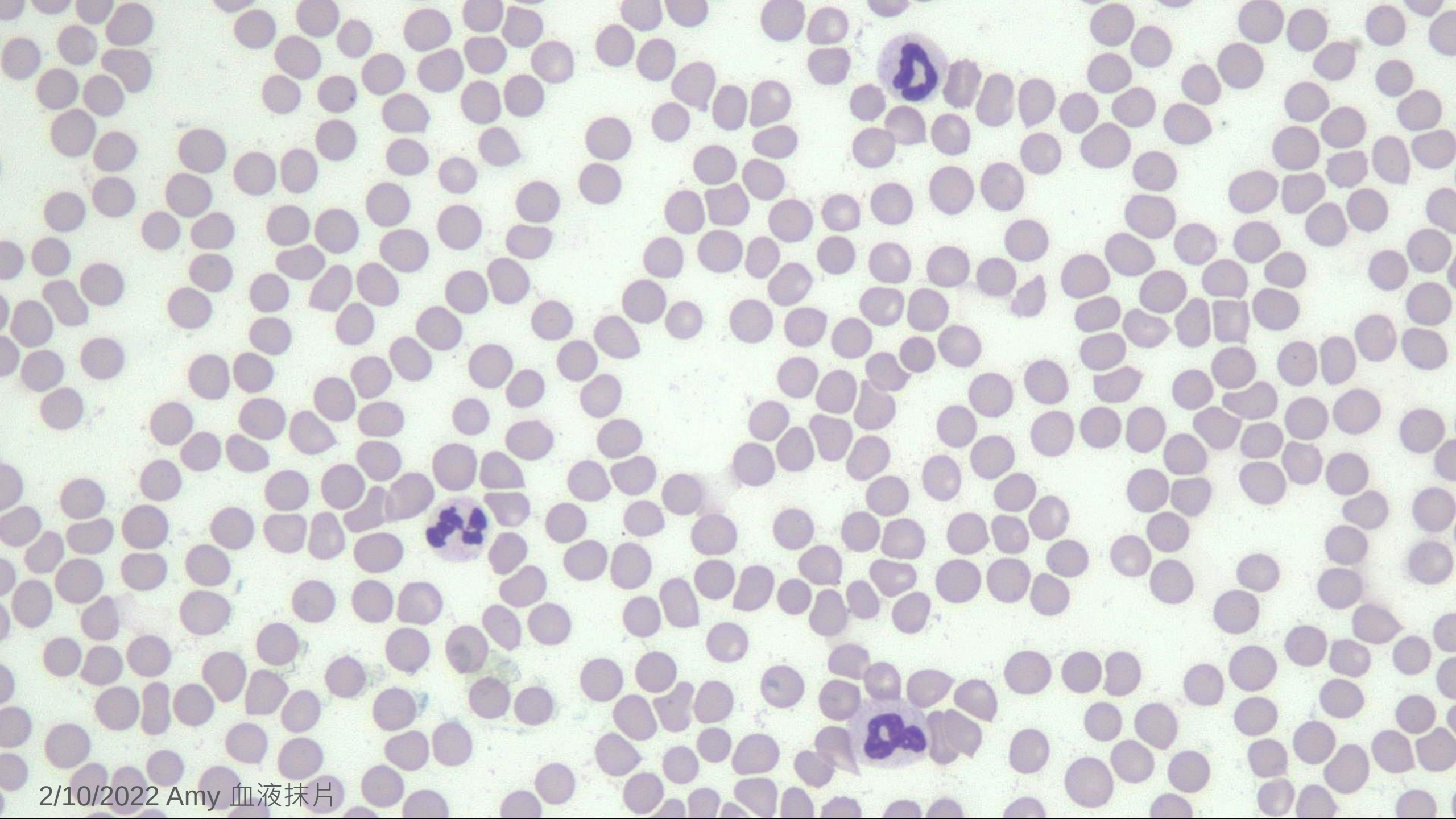
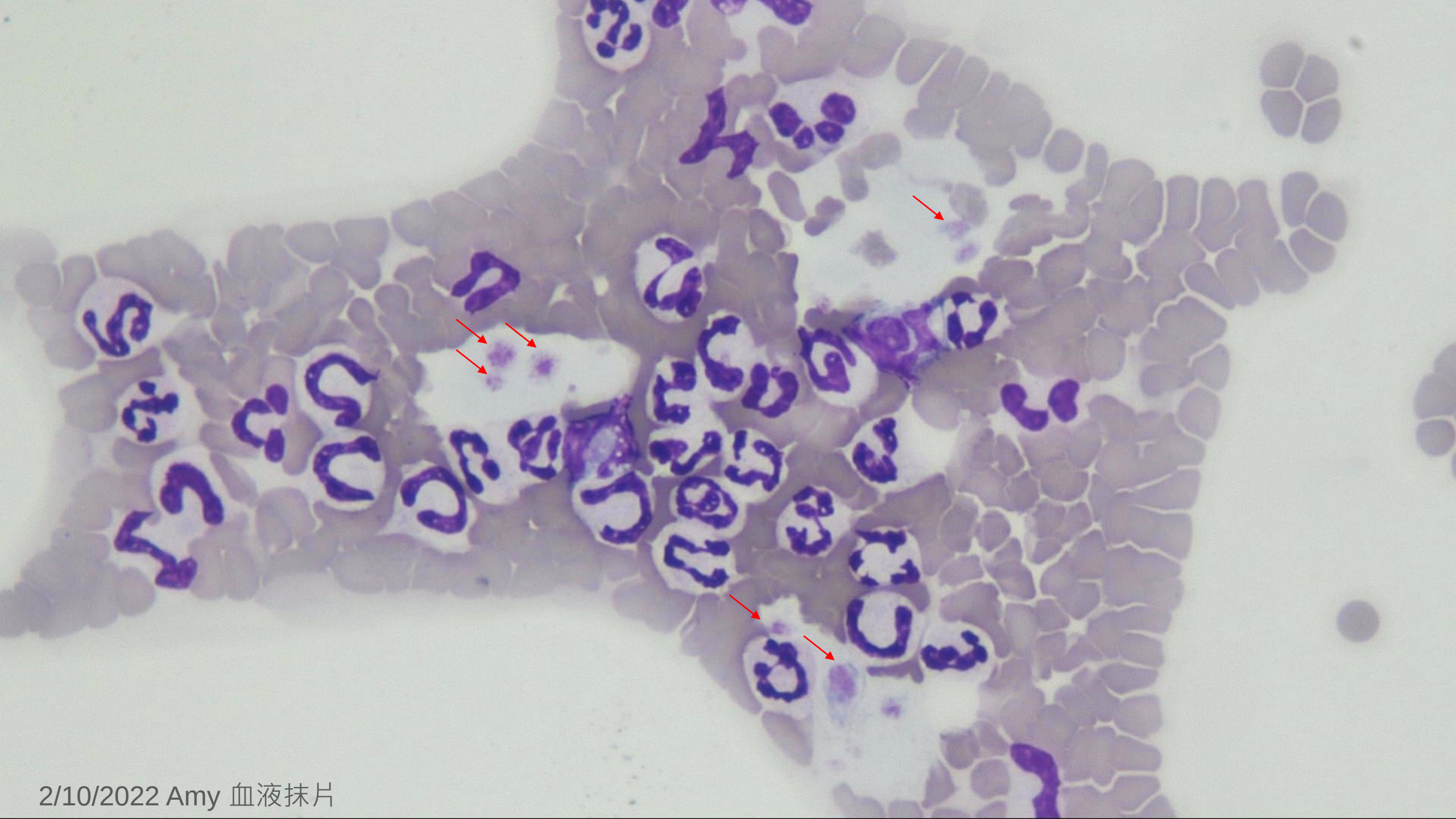
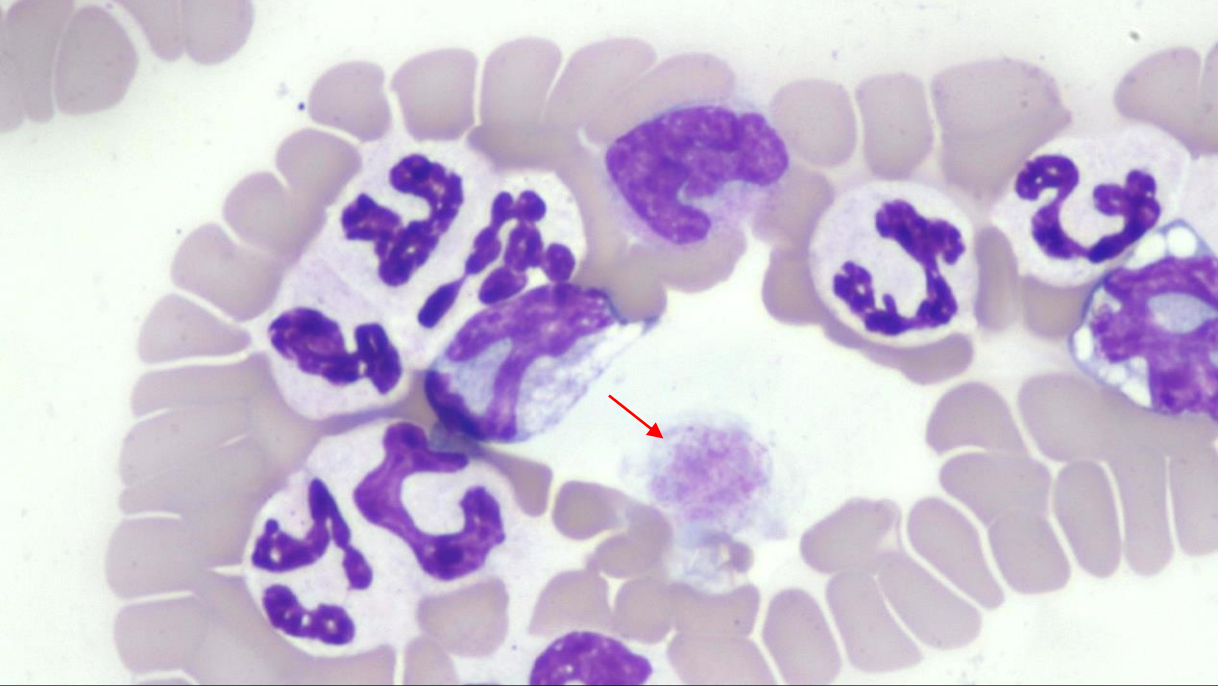
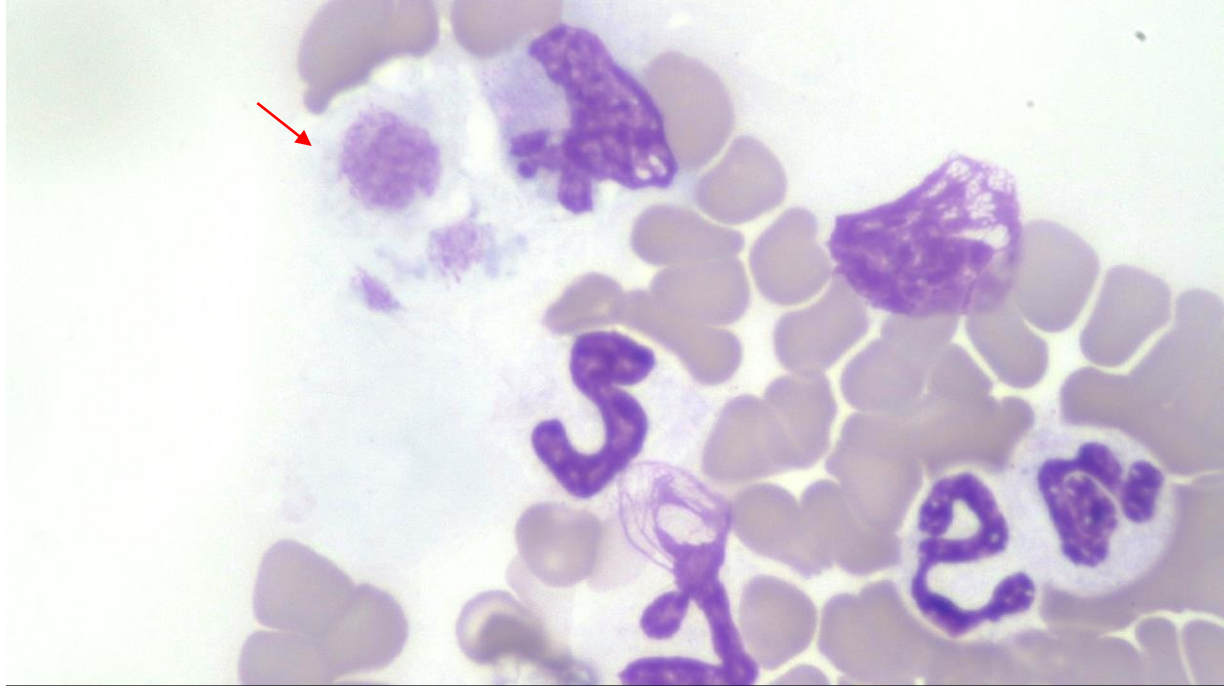
PCT= 0.00 ↓
MPV=17.6 ↑


2/10/2022 Amy 血液抹片

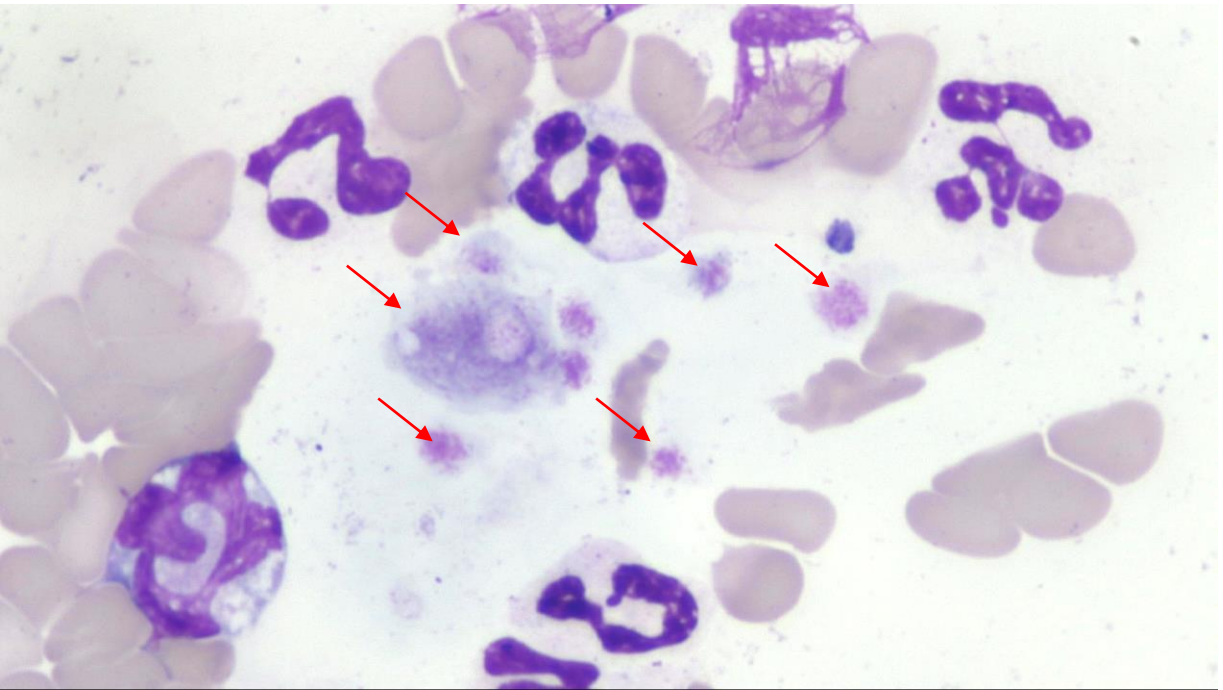


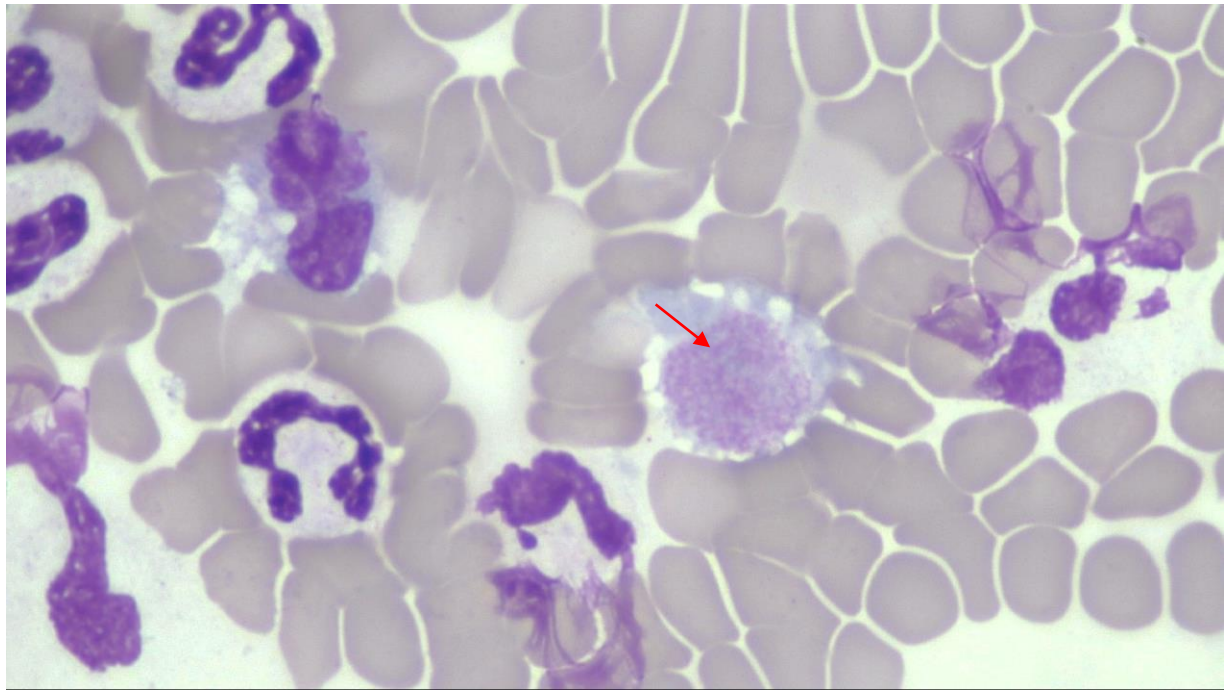
2/10/2022 Amy 血液抹片





2/10/2022 Amy 血液抹片





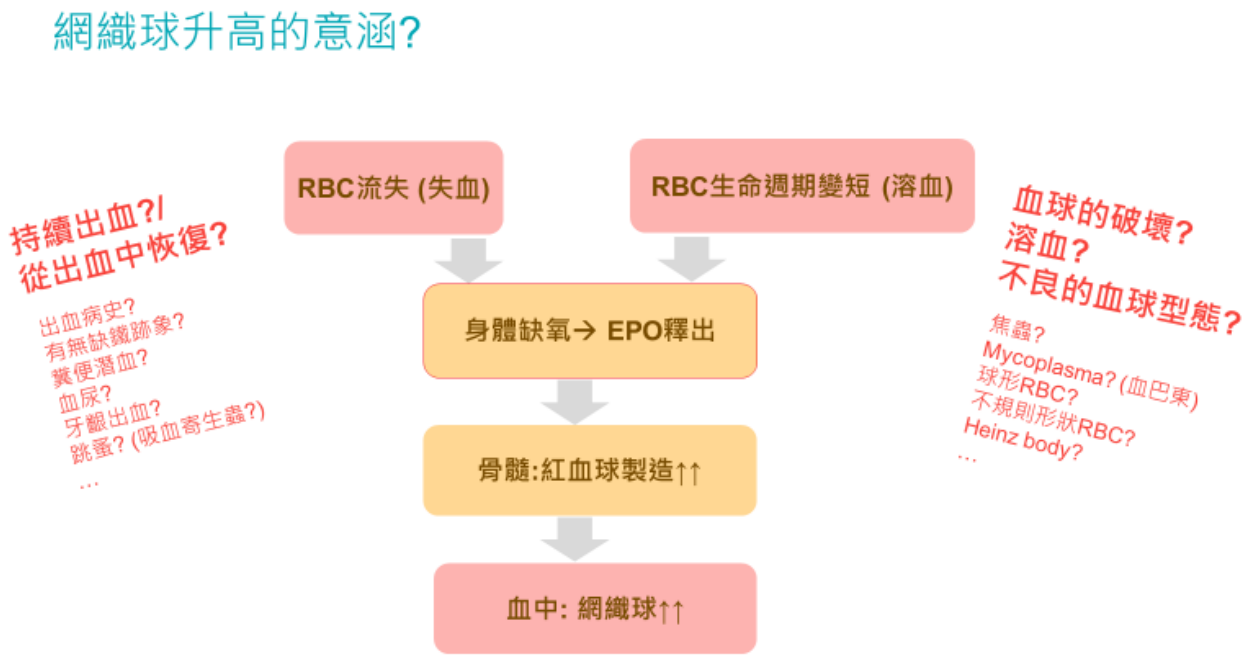
來個小總結

網網網 織球增多的時候

- 雖然動物看起來沒事，但是要緊張一下..

- 回溯病史、臨床症狀、排除潛在疾病。
  - 沒有出血/潛血嗎?
  - 沒有異常RBC型態?
  - 健檢的時候也是高的嗎?

- 持續追蹤



血小板有紅字的時候

- PCT是不是夠用?
- 血小板點狀圖是不是好的? (有沒有血小板凝塊)
- 血液抹片看了沒?
- 低下的原因 (認真的回溯病史)
- 升高的原因 (認真的回溯病史)