網織球之臨床運用2: 常見非再生性貧血之臨床診斷

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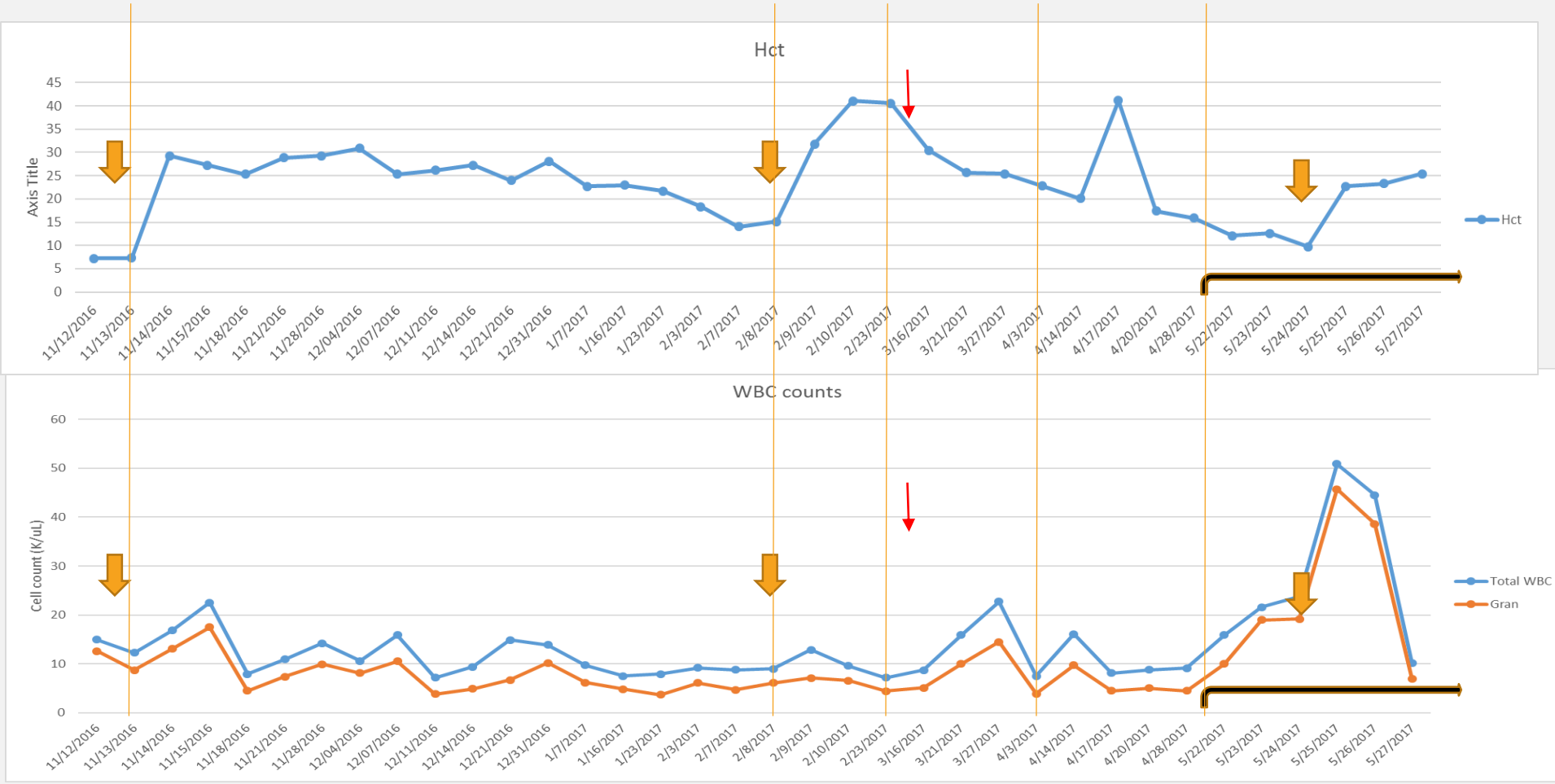
1. 在我們的獸醫日常當中，我們常用於治療貧血的選擇有哪些? (多選)

- 1. 給予鐵劑
- 2. 給予紅血球生成素(EPO 或 DPO)
- 3. 摘除脾臟
- 4. 輸血
- 5. 給予類固醇(或其他免疫抑制藥物)
- 6. 給予Doxy (或其他血液殺寄生蟲抗生素)
- 7. 其他..

神秘案例 1號



Blood Transfusion. May 8th Stopped giving cyclosporine. Mar 7th OHE

貧血是一種症狀

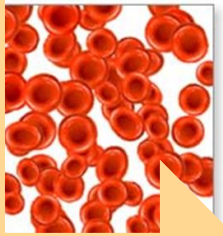
貧血是一種因為生理異常導致的現象

不是最終診斷

了解這個現象可以幫助我們找到真正的病因

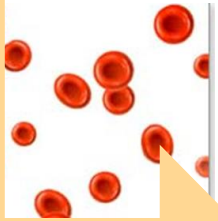
貧血如何產生?

骨髓



在狗，RBC壽命大約是3個月。
每天，大約有1%的RBC誕生，取代老化的RBC。

1. RBC 生成 ↓
2. RBC 流失/消耗 ↑
3. RBC 存活時間 ↓



貧血

2. 你認為我們的神祕案例為何會貧血呢?? (複選)

- 1. 炎症反應造成的RBC生成抑制
- 2. 血液寄生蟲造成的RBC破壞
- 3. 失血導致的貧血
- 4. 溶血疾病導致的貧血
- 5. 營養不良導致的貧血
- 6. 慢性腎病造成貧血
- 7. 自體免疫疾病造成貧血
- 8. 骨髓壞死導致貧血
- 9. 腫瘤導致貧血
- 10. 其他..
- 11. 我不知道捏…

你認為我們的神祕案例為何會貧血呢?? (複選)

- 1. 炎症反應造成的RBC生成抑制 → **RBC生成減少**
- 2. 血液寄生蟲造成的RBC破壞 → **RBC存活時間 縮短**
- 3. 失血導致的貧血 → **RBC流失 增加**
- 4. 溶血疾病導致的貧血 → **RBC存活時間 縮短**
- 5. 營養不良導致的貧血 → **RBC生成減少** → **RBC存活時間 縮短**
- 6. 慢性腎病造成貧血 → **RBC生成減少**
- 7. 自體免疫疾病造成貧血 → **RBC存活時間 縮短** → **RBC生成減少**
- 8. 骨髓壞死導致貧血 → **RBC生成減少**
- 9. 腫瘤導致貧血 → **RBC生成減少**
- 10. 其他..
- 11. 我不知道捏…

3. 你認為哪些額外的訊息可能可以幫助我們推測出貧血原因?? (複選)

- 1. 病史資訊
- 2. 用藥史
- 3. 嗜中性球(NEU)數量
- 4. 血小板(PLT)數量
- 5. 網織球(RET)數量
- 6. RBC型態
- 7. 血液培養
- 8. 血液病原PCR
- 9. 骨髓採樣
- 10. 其他..
- 11. 我不知道捏…

前情提要...

不再生的貧血

一個沒有再生的貧血.....

貧血的成因

- **RBC 耗損增加**

Increased blood loss.

(創傷, 失血, 吸血的寄生蟲)

- **RBC生存時間縮短**

Increased blood cell destruction.

(血球生成不良, 血球被感染, 自體免疫, 毒素)

- **RBC 生成減少**

Decreased blood cell production.

再生性的貧血

Regenerative Anemia

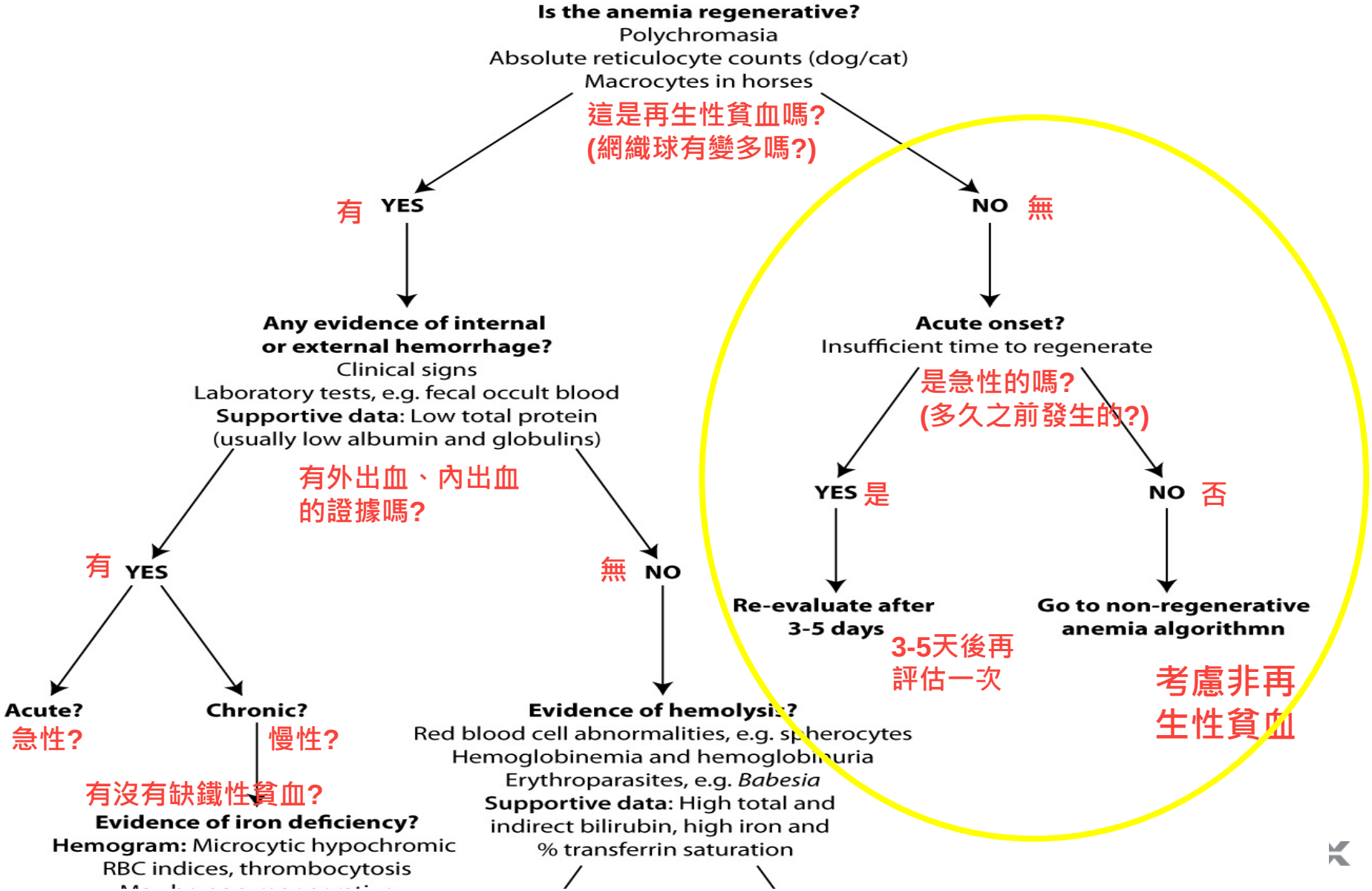
OR

非再生性的貧血

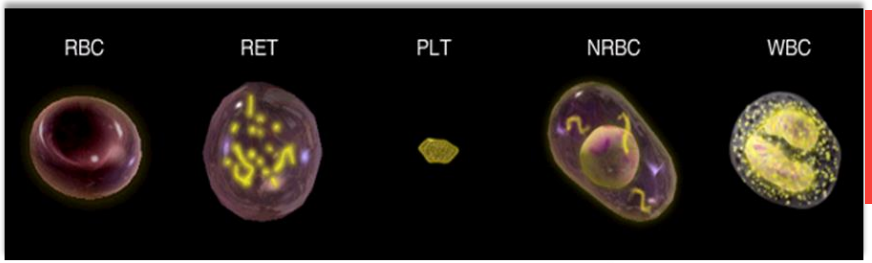
Non-regenerative Anemia

利用網織球進行區別診斷

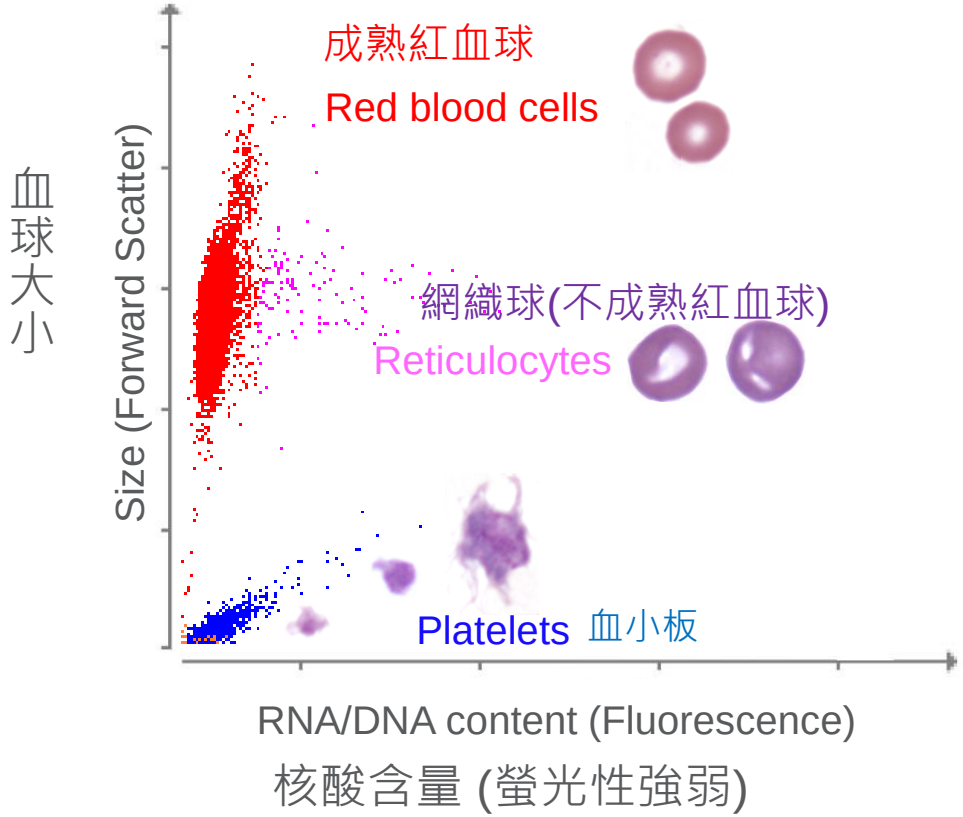
https://eclinpath.com/hematology/anemia/mechanisms-of-anemia/anemia-algorithmn/



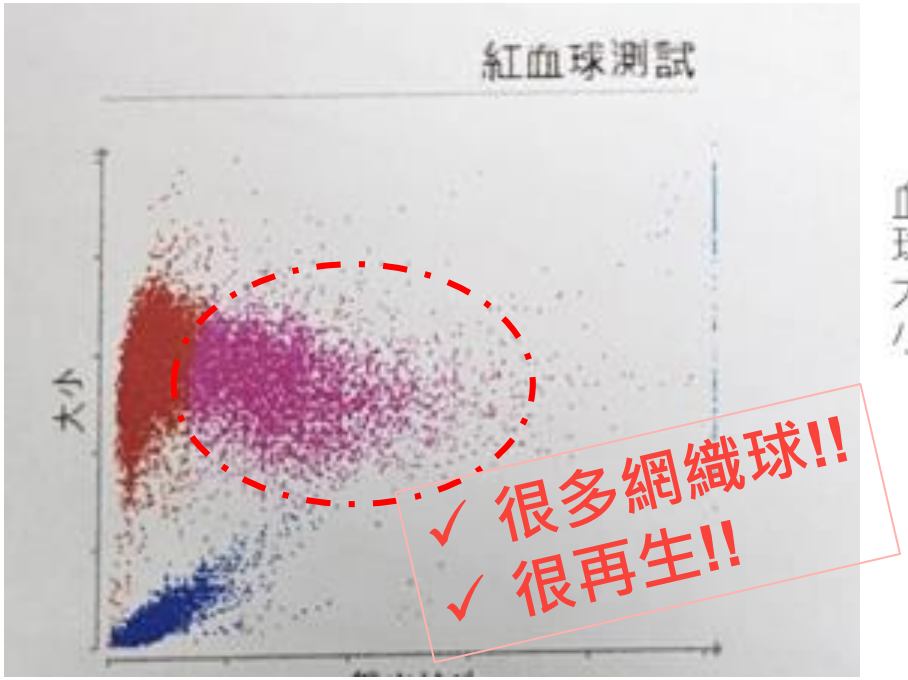
網織球的測量

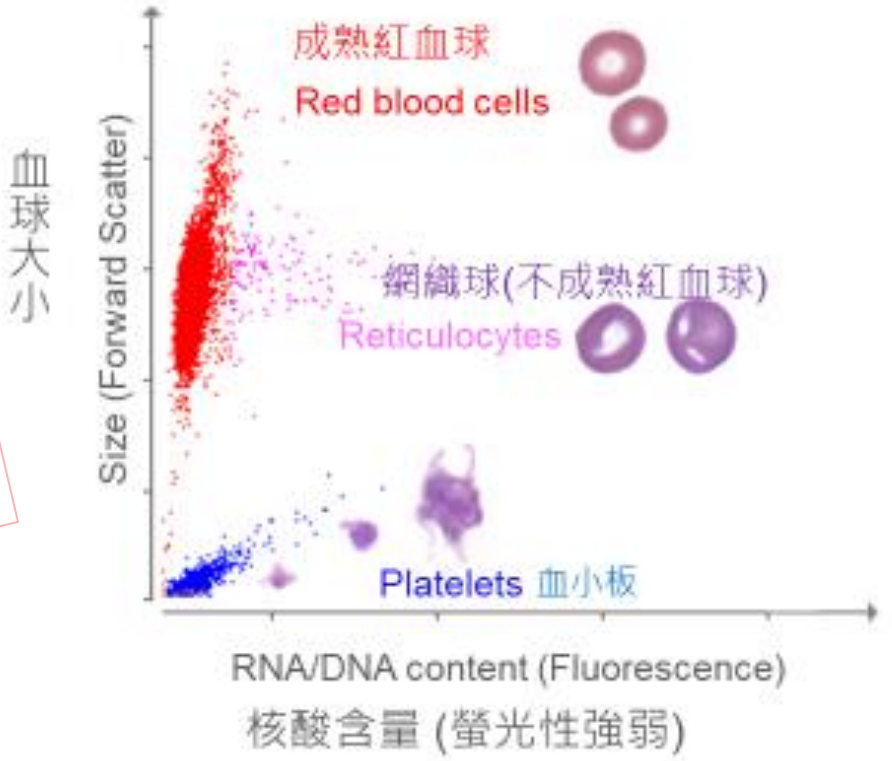


1. Auto Reader (螢光染色; 只有%)
2. ProCyte Dx (螢光染色)
3. 新甲基藍染色 (傳統手工染色計數)



網織球的ProCyte點狀圖分布





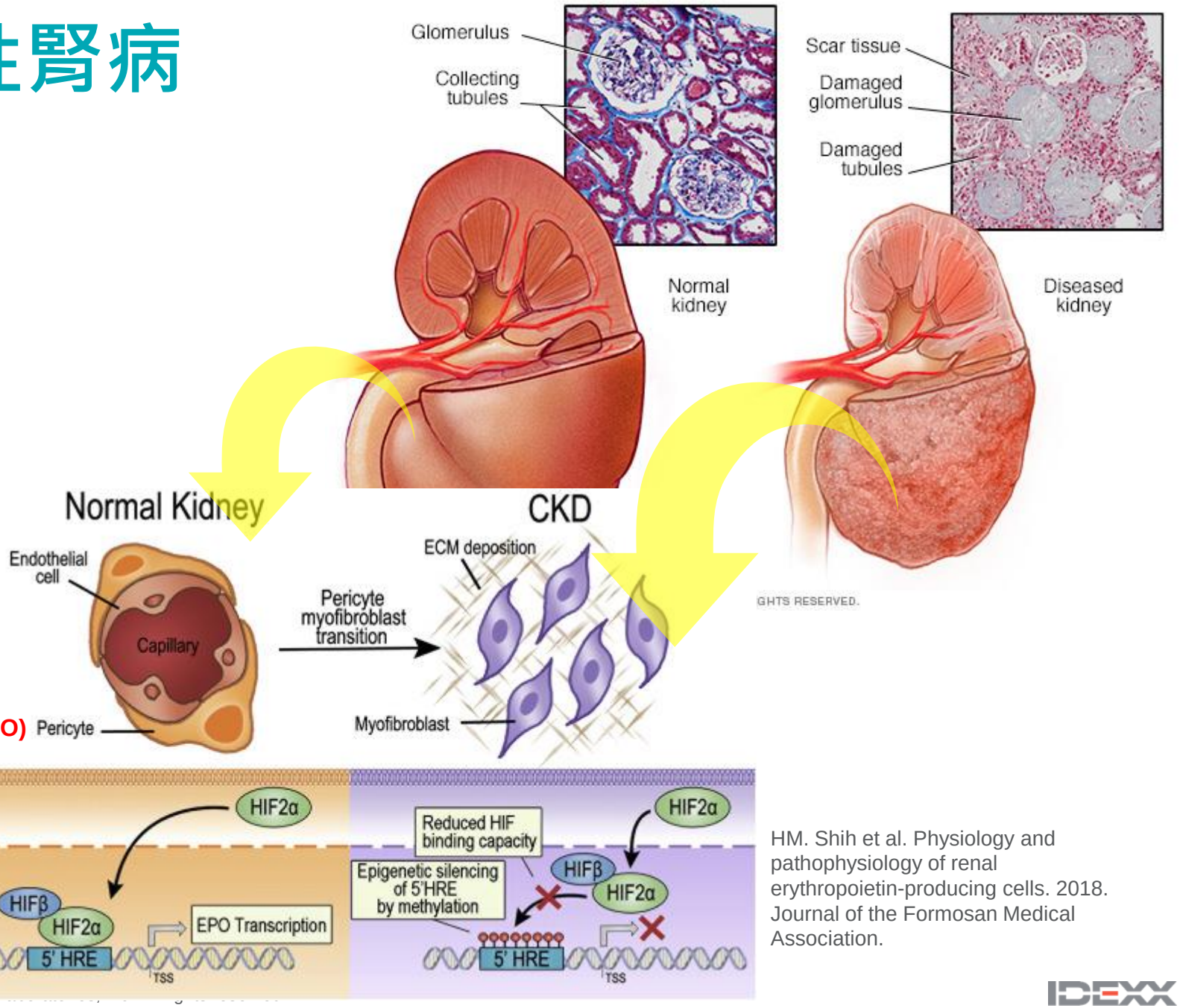
骨髓沒有壞掉的**非再生性貧血**

還有救!!!

非再生性貧血的病因思考

- **骨髓的抑制**
  - 系統性炎症
  - 艾莉希體感染
  - 缺鐵
  - 肝功不良
- **缺乏造血的訊號**
  - 慢性腎病 (EPO缺乏)
- **缺乏造血細胞**
  - 自體免疫 (Pure red cell aplasia)
  - 骨髓壞死 (病毒感染 Ex. Parvo)
  - 中毒 (藥物、Estrogen、中金屬)
  - 腫瘤轉移到骨髓
- **癌化**
  - 血球生成不良 (dysplasia)
  - 血液腫瘤

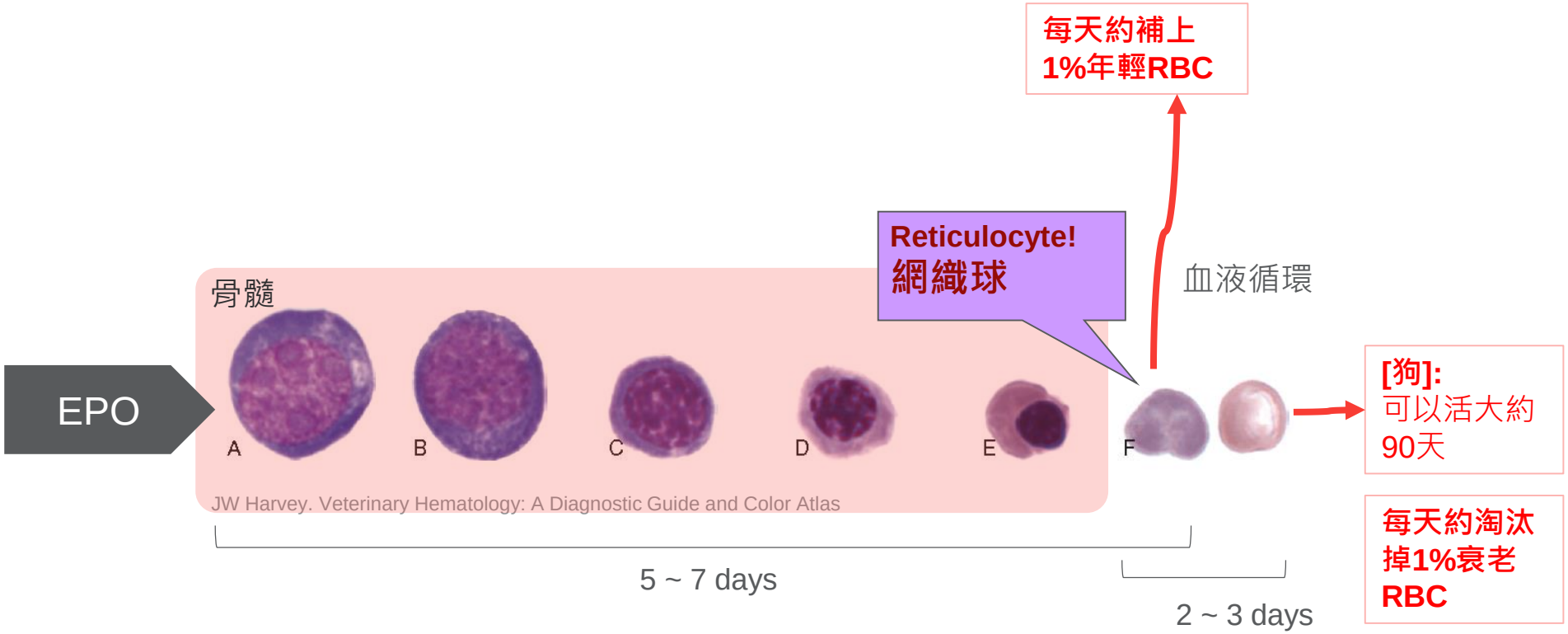
慢性腎病



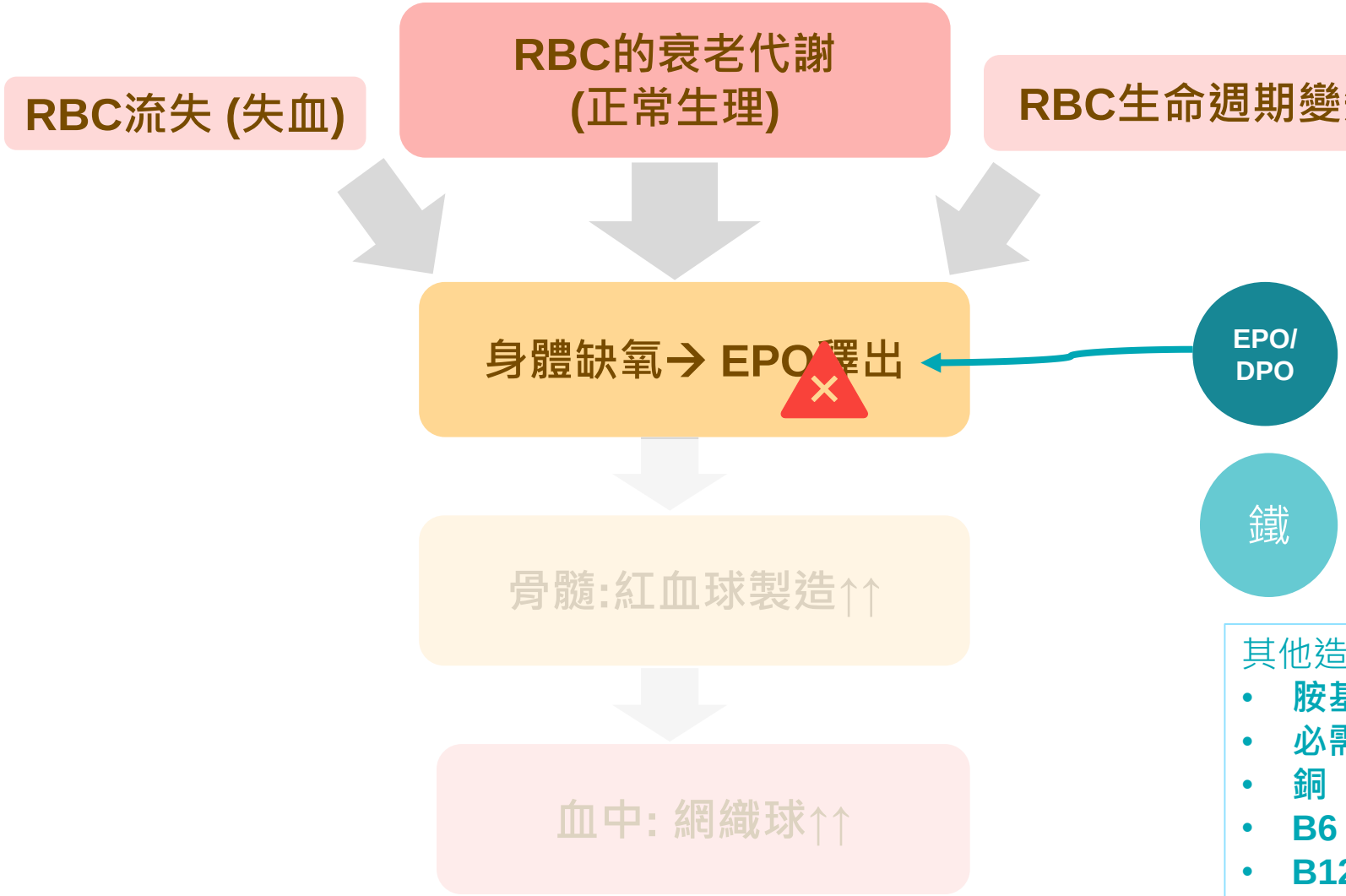
產生
紅血球生成素(EPO)

HM. Shih et al. Physiology and pathophysiology of renal erythropoietin-producing cells. 2018. Journal of the Formosan Medical Association.

網織球的生成 與 臨床意義



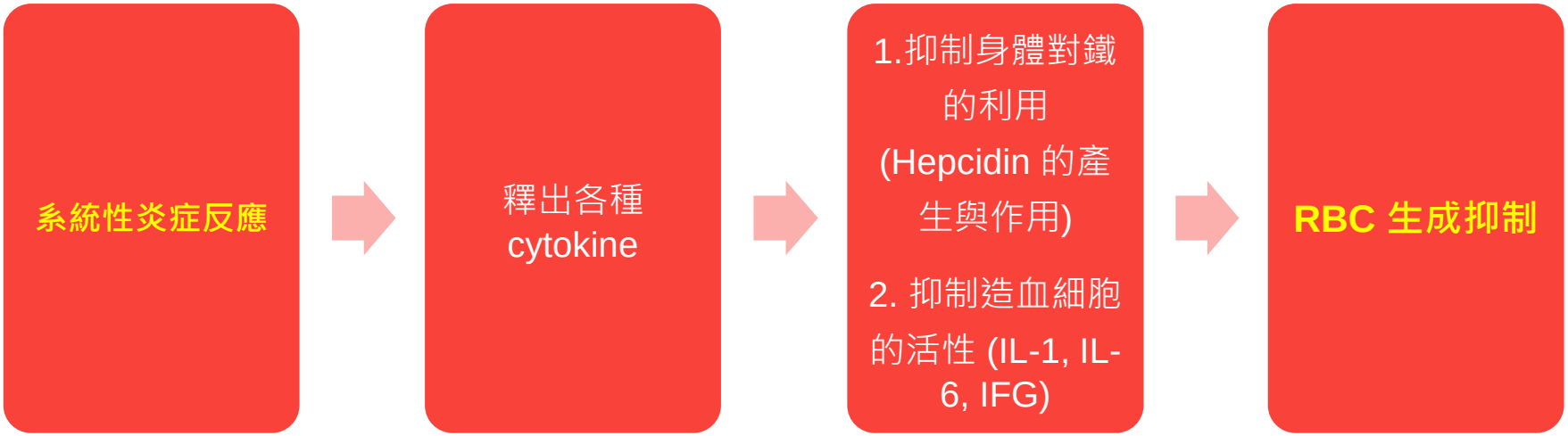
慢性腎病的治療決策



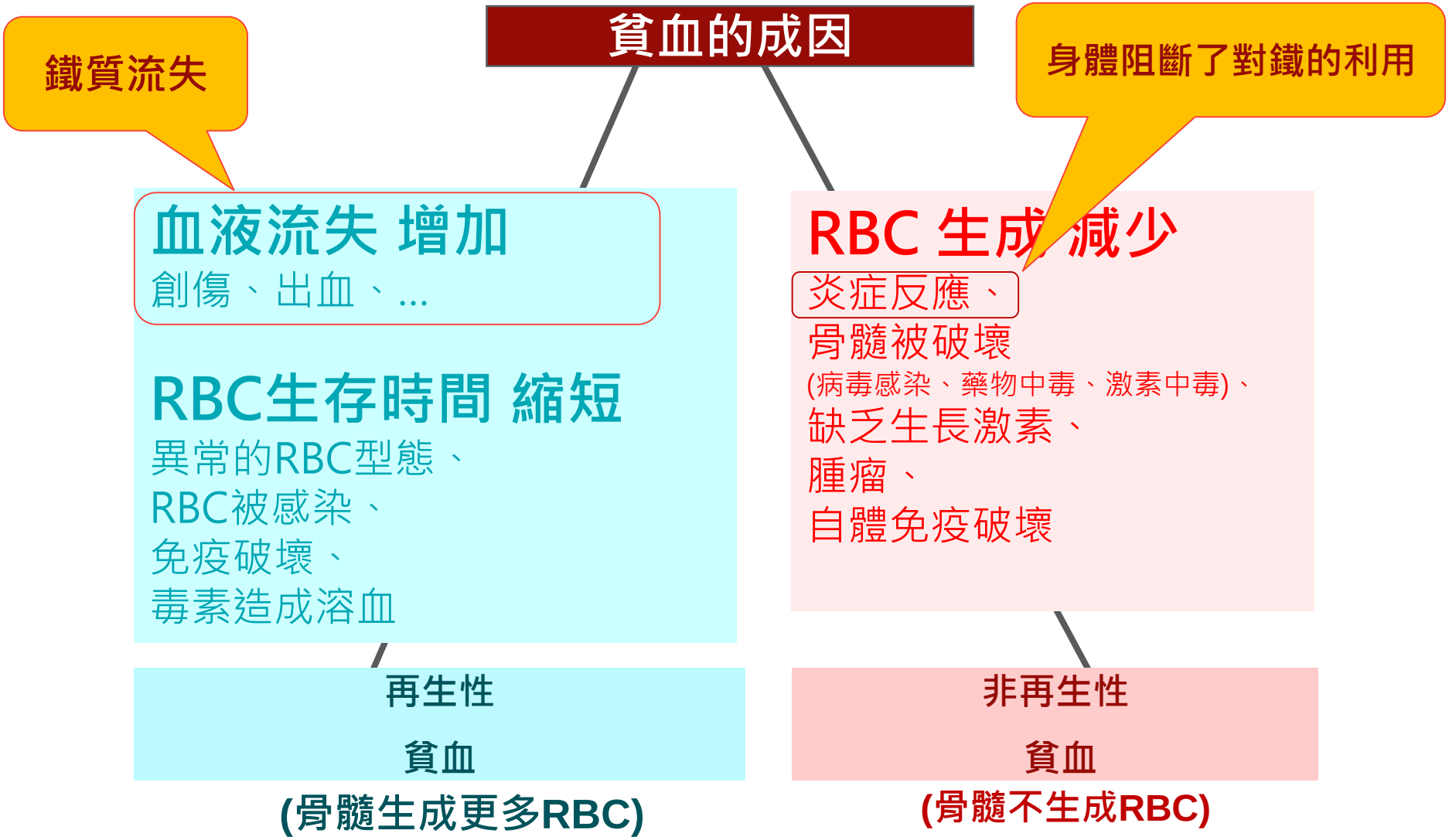
其他造血養分:

- 胺基酸
- 必需脂肪酸
- 銅
- B6
- B12
- Folic Acid(B9)

系統性炎症反應



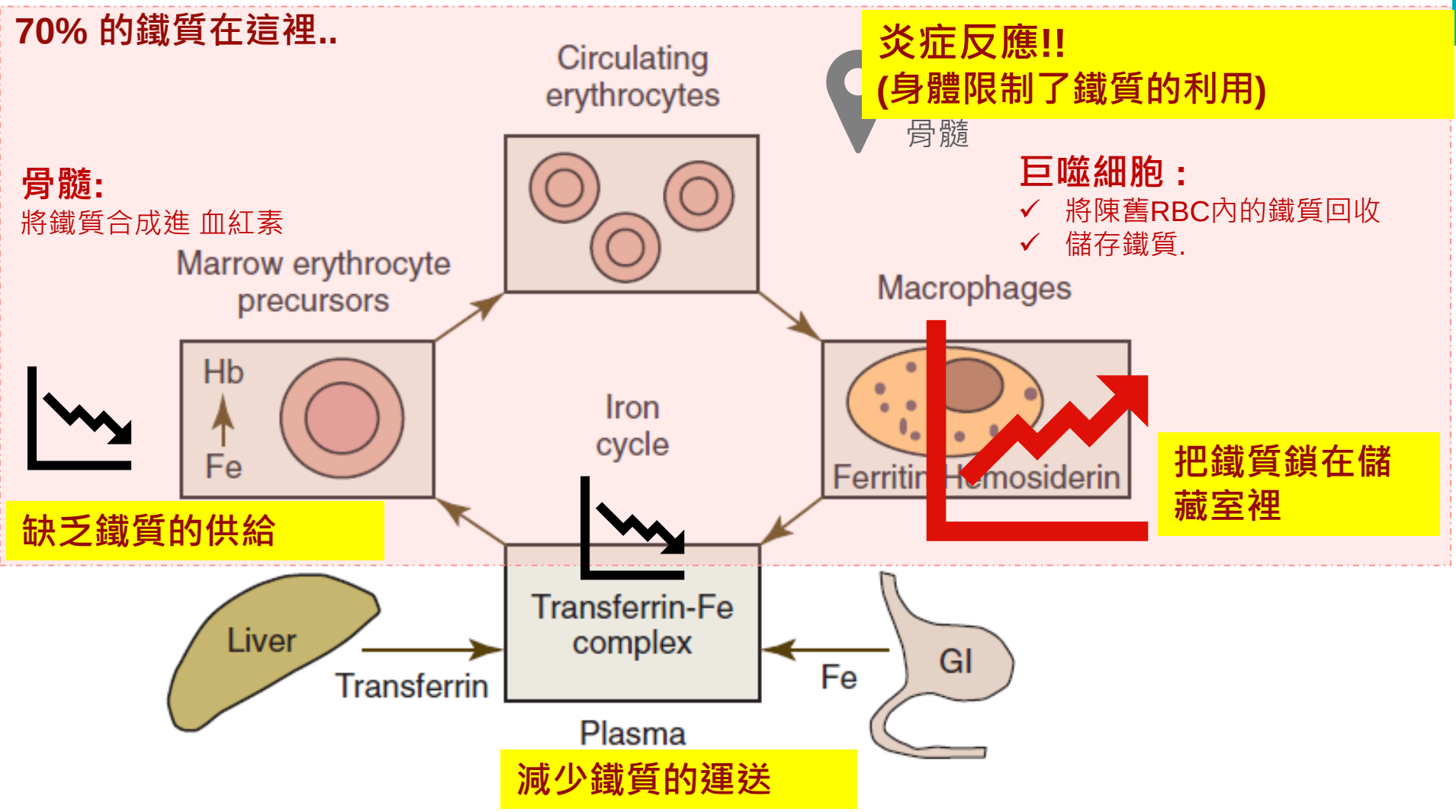
常見造成缺鐵性貧血的原因之一



體內 鐵質代謝的調控

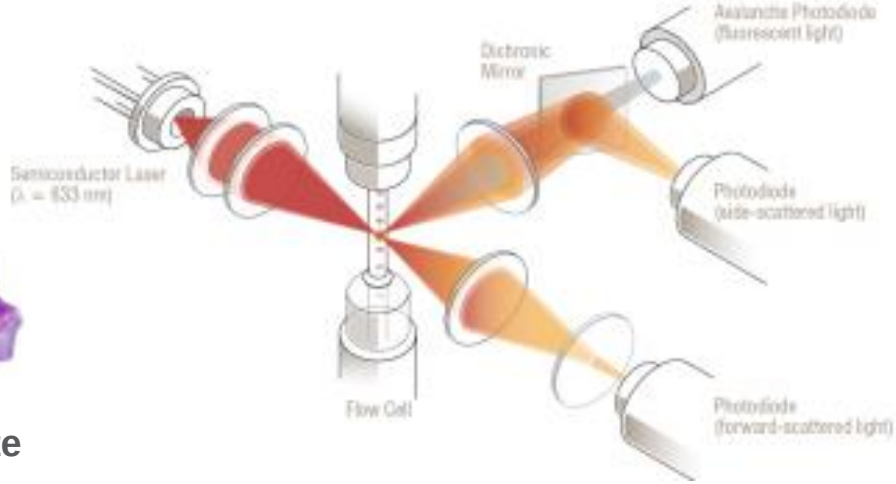
70% 的鐵質在這裡..

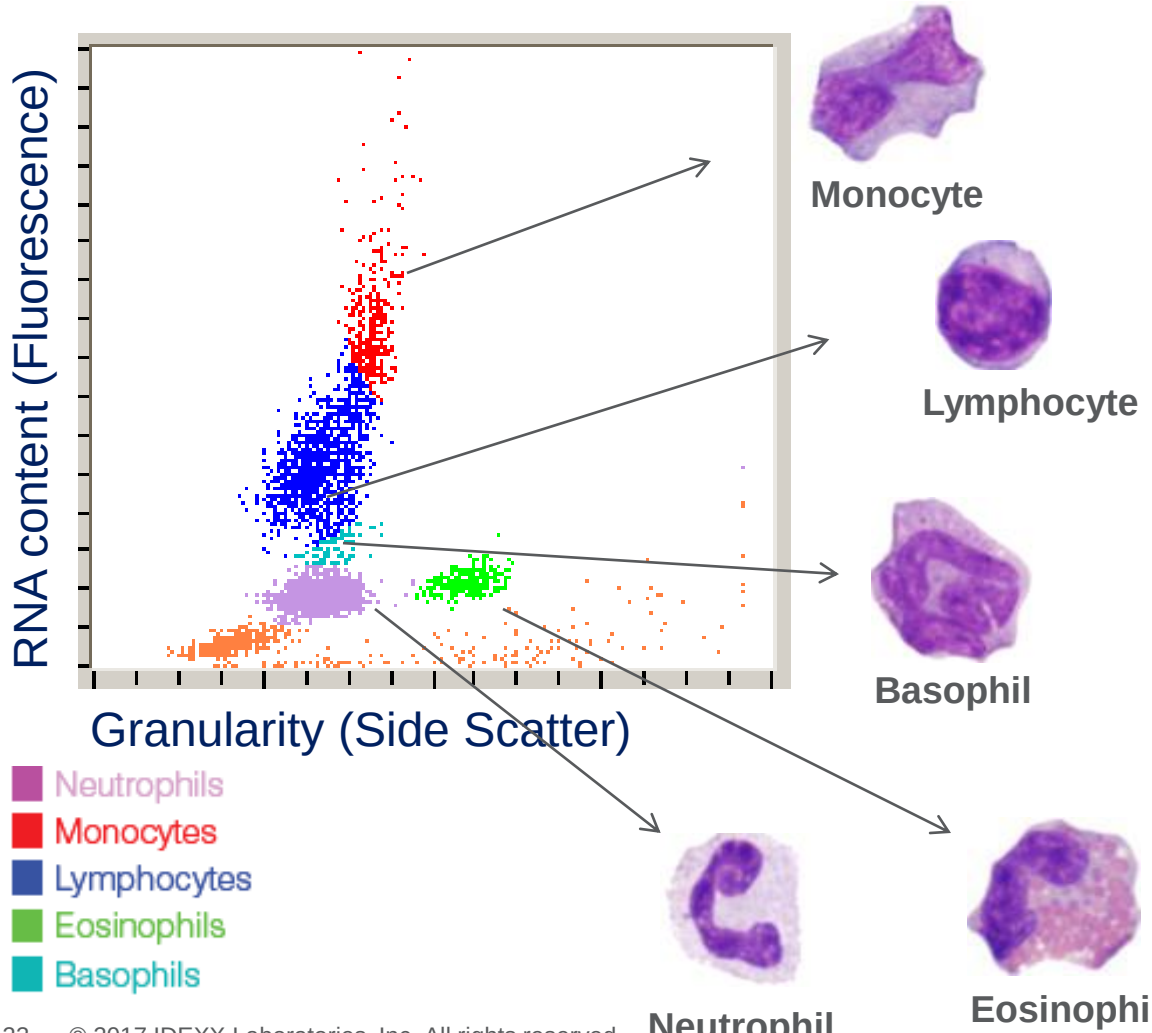
炎症反應!!
(身體限制了鐵質的利用)



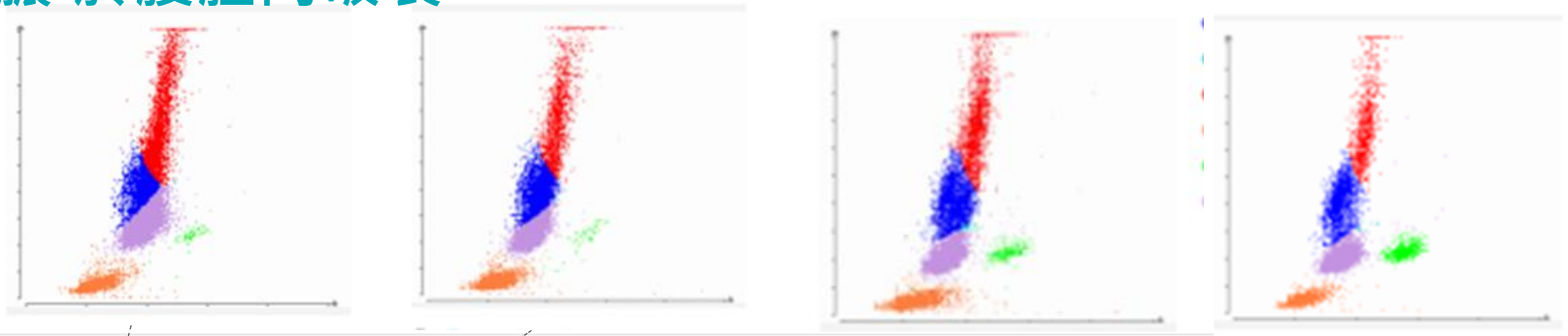
From Harvey JW. Iron metabolisms and its disorders. In: Kaneko JJ,Harvey JW, Bruss ML, eds. Clinical Biochemistry of Domestic Animals,6th ed. San Diego, CA: Academic Press; 2008:259-285.

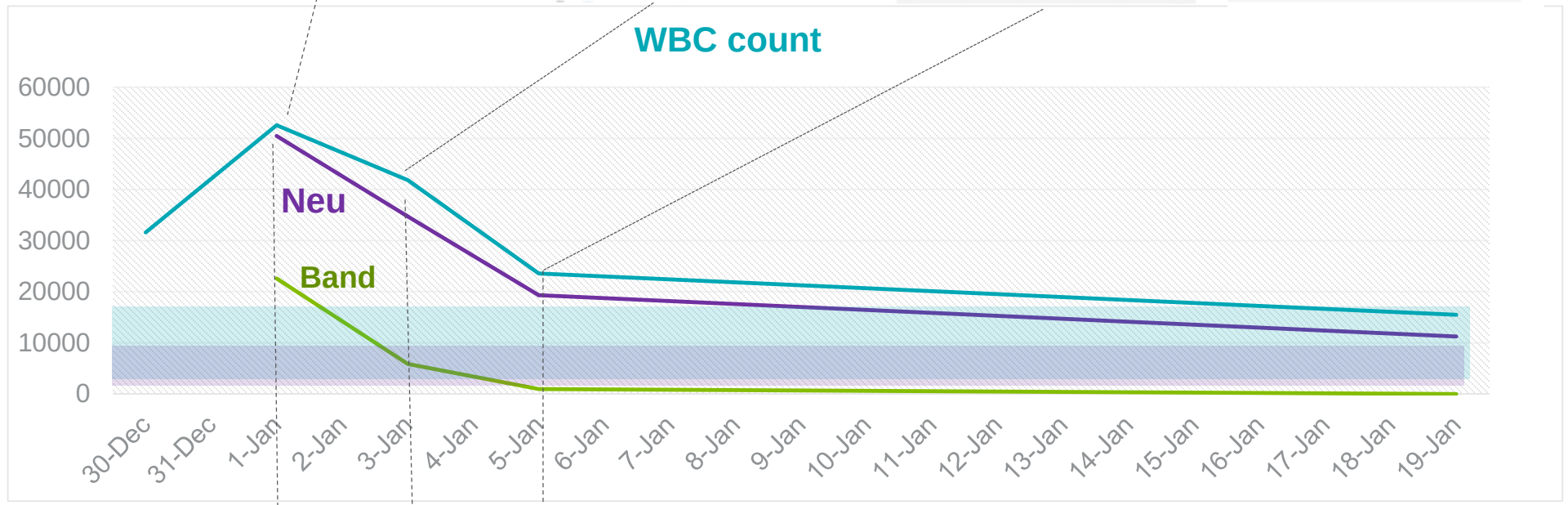
複習: ProCyte 白血球點狀圖





子宮蓄膿 於腹腔內破裂




WBC count
60000
50000
40000
30000
20000
10000
0
Neu
Band
30-Dec
31-Dec
1-Jan
2-Jan
3-Jan
4-Jan
5-Jan
6-Jan
7-Jan
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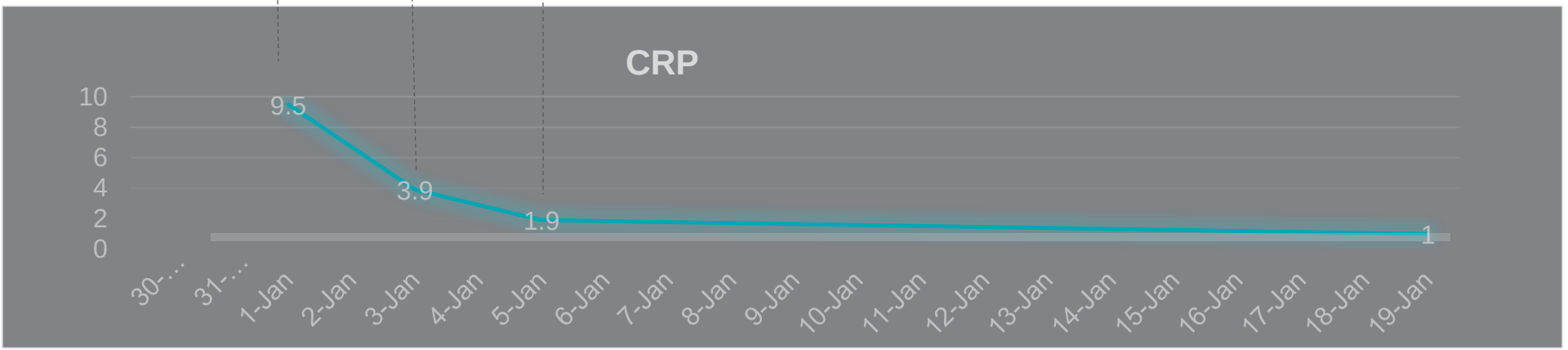
9-Jan
10-Jan
11-Jan
12-Jan
13-Jan
14-Jan
15-Jan
16-Jan
17-Jan
18-Jan
19-Jan


CRP
10
8
6
4
2
0
9.5
3.9
1.9
1
30-…
31-…
1-Jan
2-Jan
3-Jan
4-Jan
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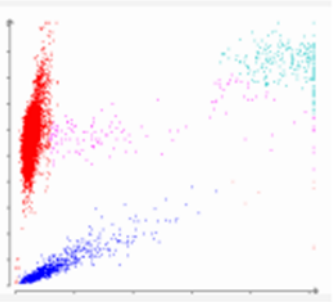
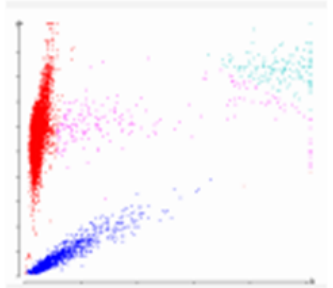
9-Jan
10-Jan
11-Jan
12-Jan
13-Jan
14-Jan
15-Jan
16-Jan
17-Jan
18-Jan
19-Jan

Case

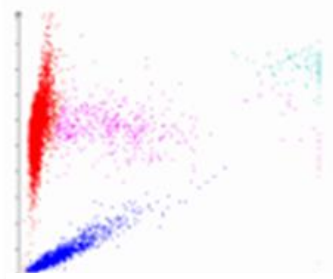
12/30/2017
Hct: 42.4 %
Ret: - - K/uL
Plt: 369 K/uL



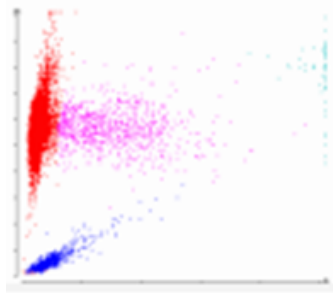
1/1/2018
Hct: 34.9%
Ret: 30.5 K/uL
Plt: 176 K/uL



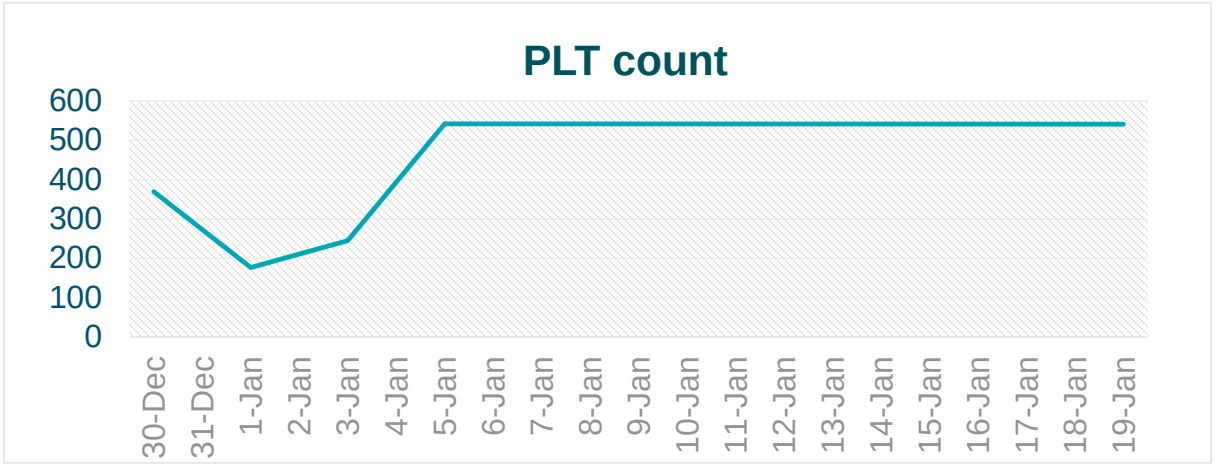
1/3/2018
Hct: 42.5%
Ret: 54 K/uL
Plt: 245 K/uL

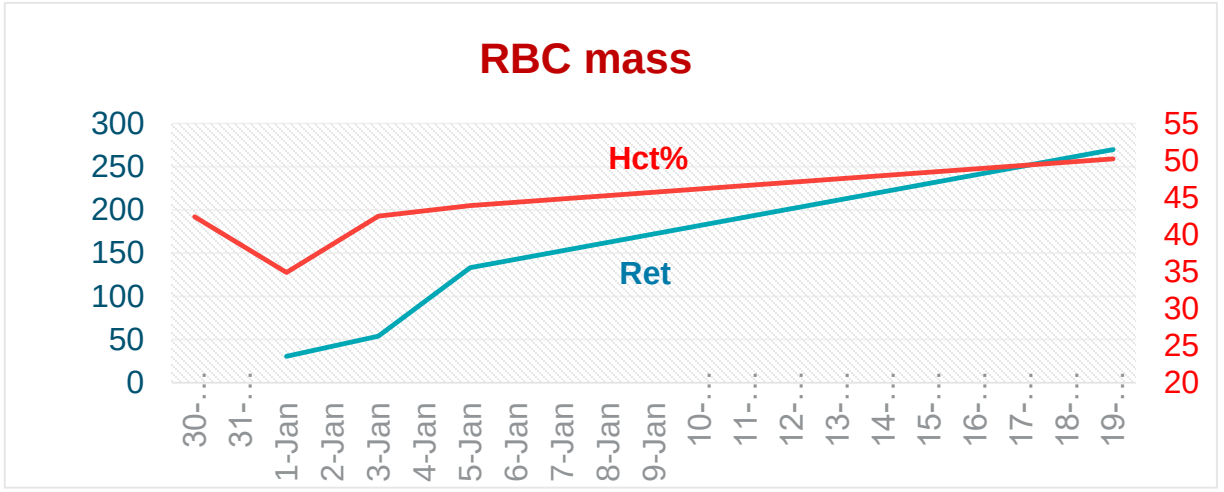


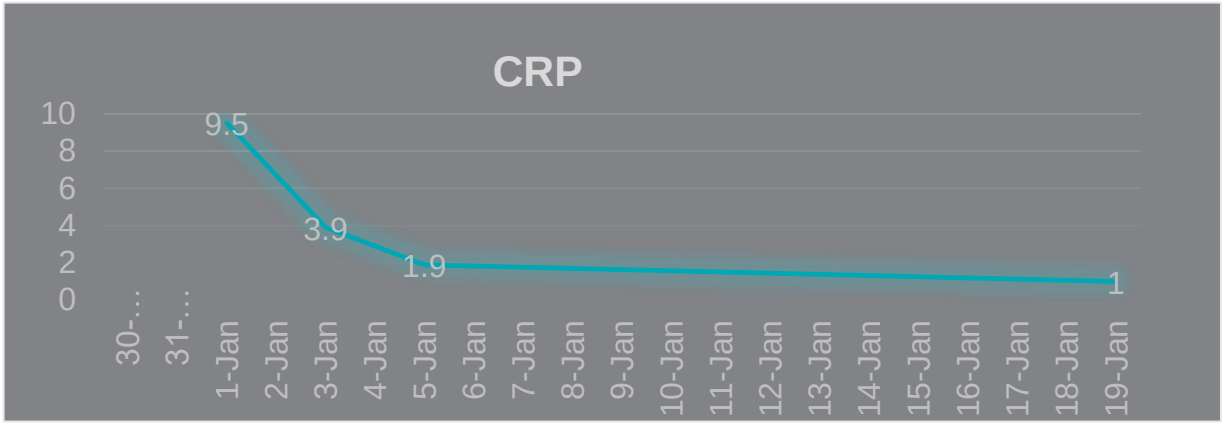
1/5/2018
Hct: 43.9.1%
Ret: 133.3 K/uL
Plt: 542 K/uL



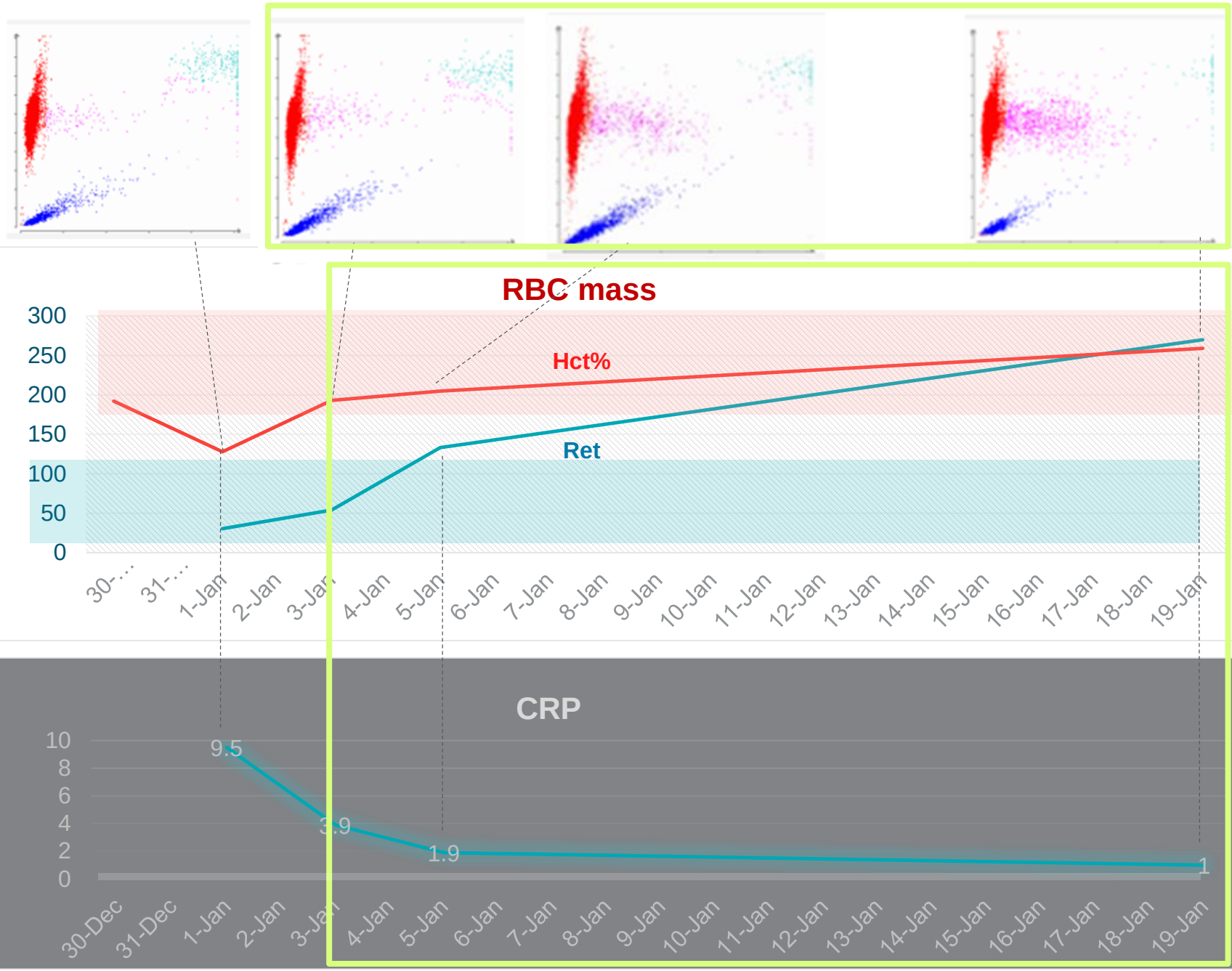
1/19/2018
Hct: 50.2%
Ret: 269.9 K/uL
Plt: 541 K/uL







Case


RBC mass
Hct%
Ret
300
250
200
150
100
50
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45
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35
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25
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30-…
31-…
1-Jan
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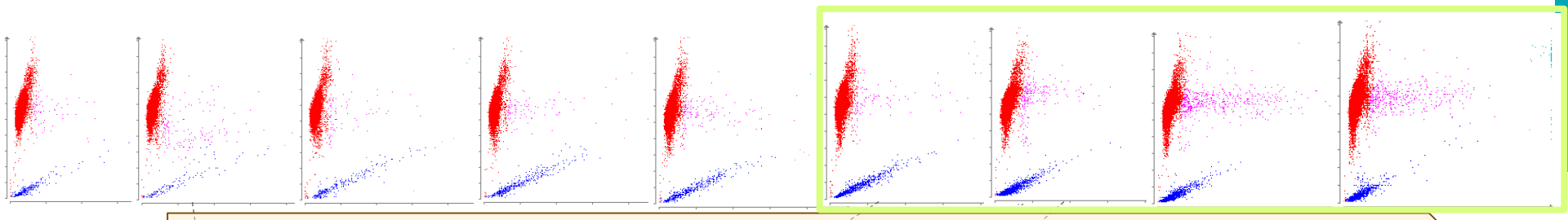
17-Jan
18-Jan
19-Jan

另一個系統性炎症的案例

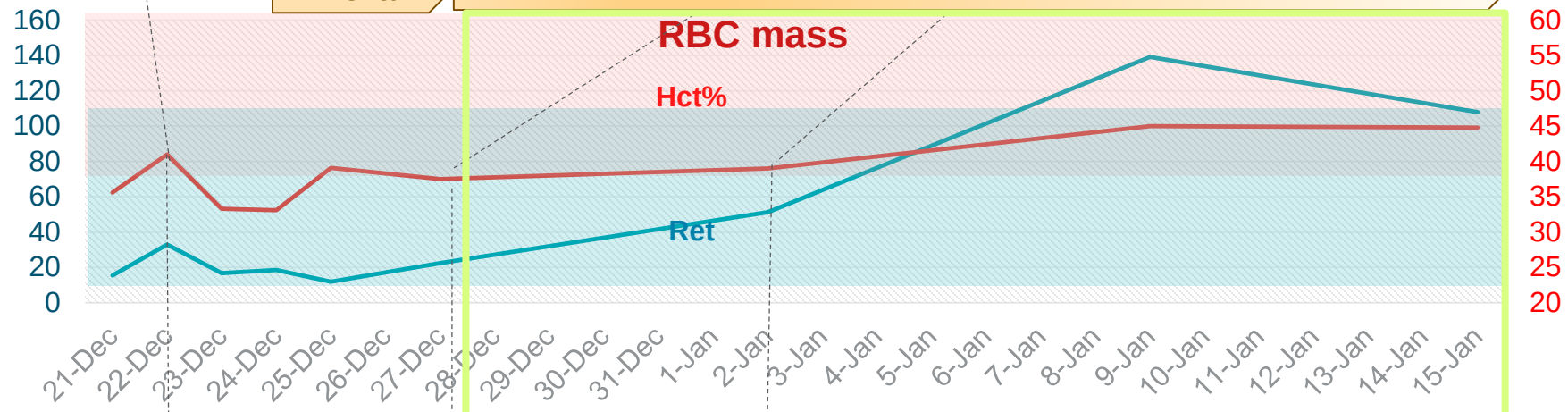
發高燒 小焦蟲+ 艾利希體 感染合併 自體免疫血小板低下症

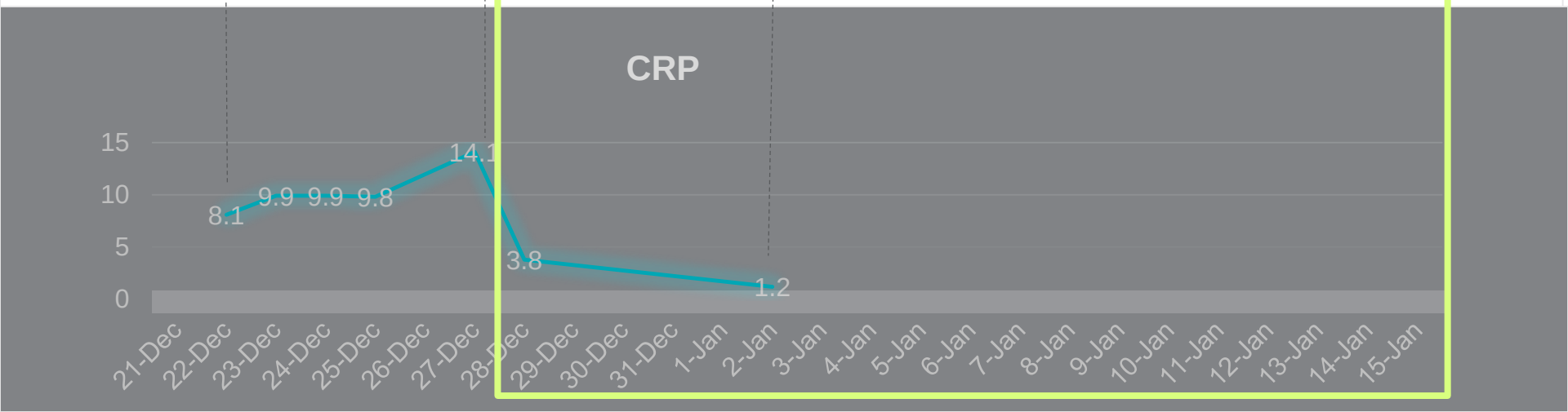


Doxycycline, Clindamycin, Metronidazole

Dexa

Pred





系統性炎症反應

ELSEVIER

Blood Cells, Molecules, and Diseases

Volume 52, Issues 2–3, February–March 2014, Pages 126-133

Interleukin-6 directly impairs the erythroid development of human TF-1 erythroleukemic cells

Bryan J. McCranor [a], Min Jung Kim [b, c, d], Nicole M. Cruz [a], Qian-Li Xue [a], Alan E. Berger [e], Jeremy D. Walston [a], Curt I. Civin [b, c, d], Cindy N. Roy [a, f]

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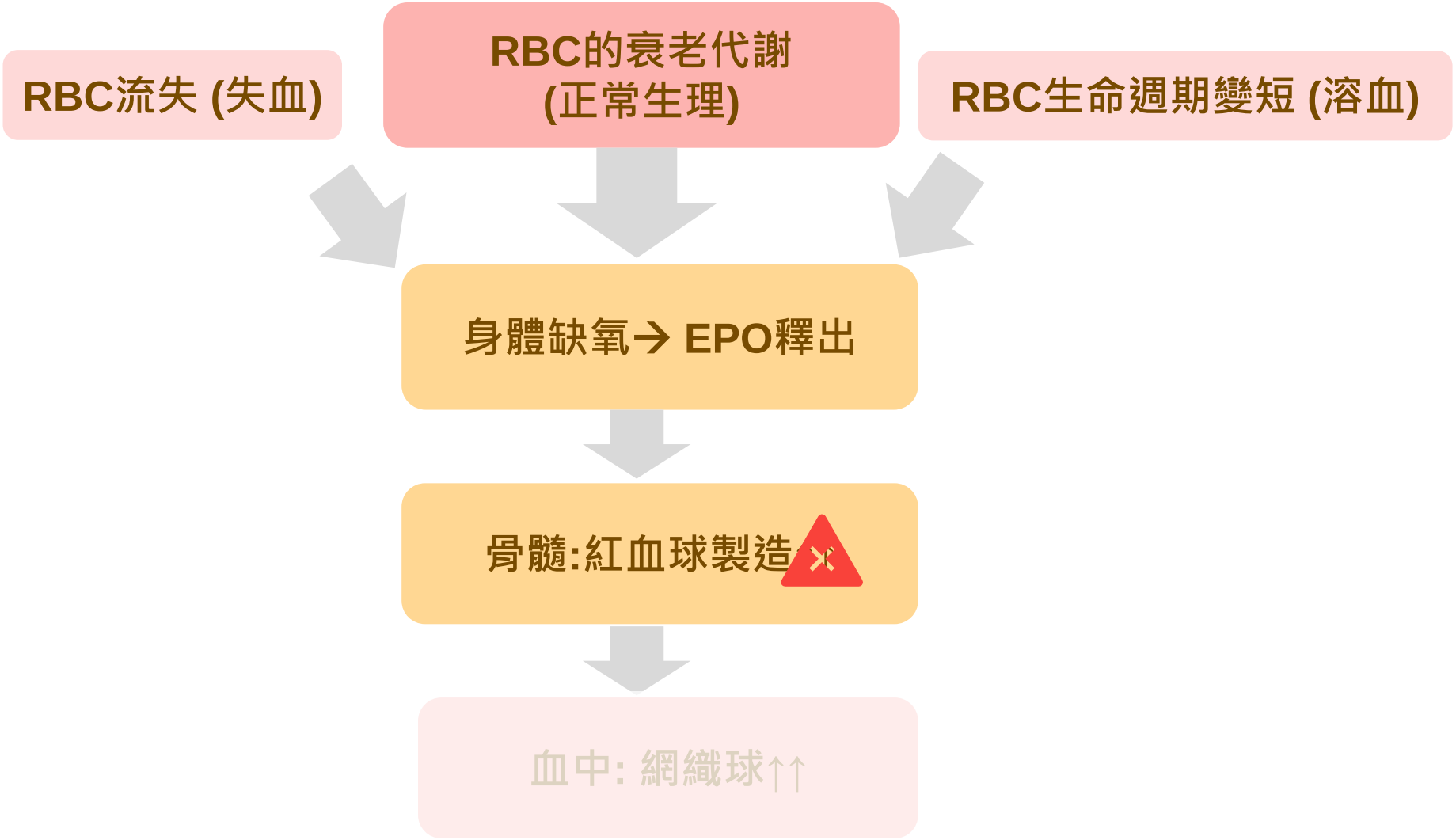
https://doi.org/10.1016/j.bcmd.2013.09.004

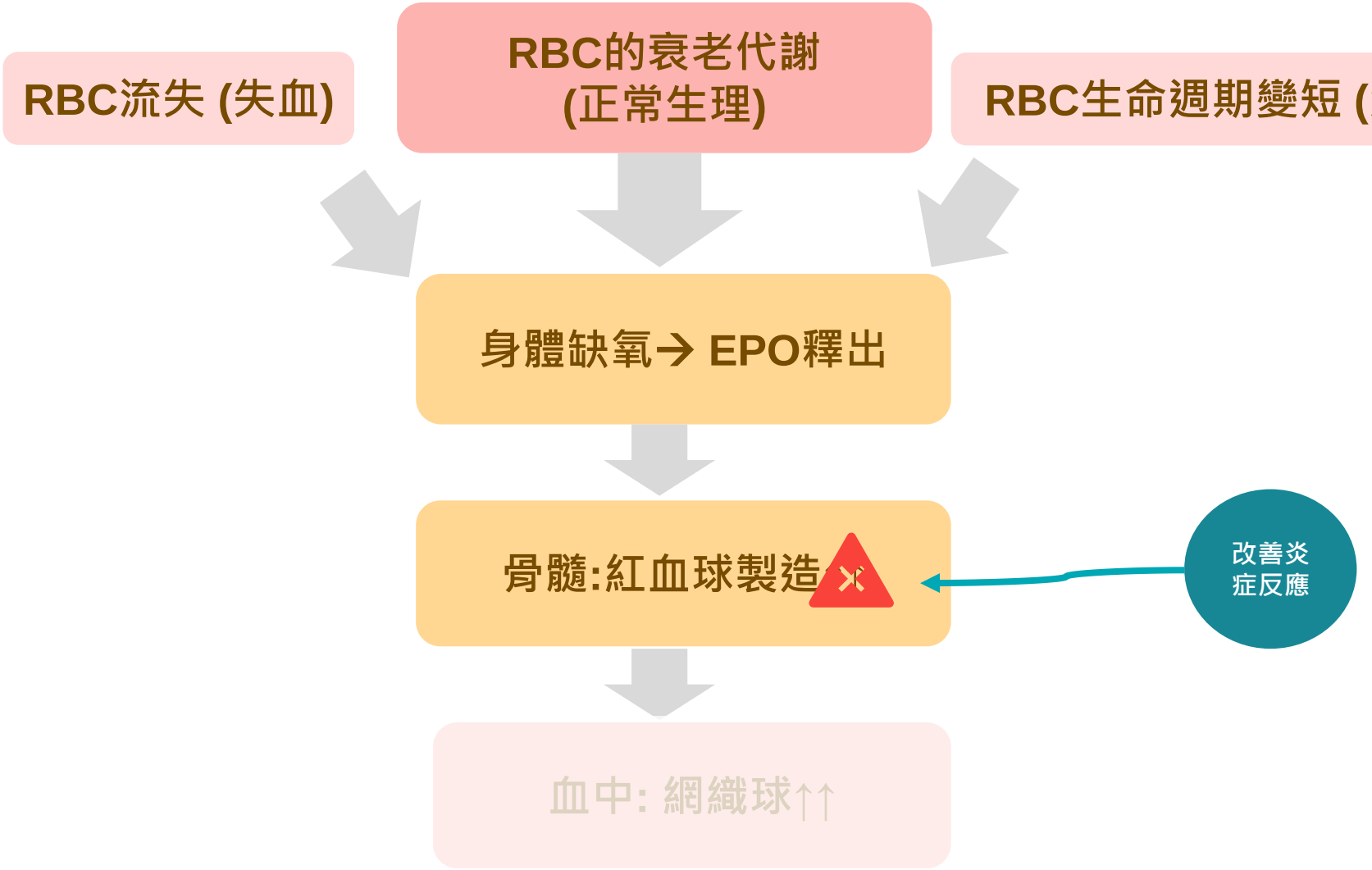
Abstract

Anemia of inflammation or chronic disease is a highly prevalent form of anemia. The inflammatory cytokine interleukin-6 (IL-6) negatively correlates with hemoglobin concentration in many disease states. The IL-6-hepcidin antimicrobial peptide axis promotes iron-restricted anemia; however the full role of IL-6 in anemia of inflammation is not well-defined. We previously reported that chronic inflammation had a negative impact on maturation of erythroid progenitors in a mouse model. We hypothesized that IL-6 may be responsible for impaired erythropoiesis, independent of iron restriction. To test the hypothesis we utilized the human erythroleukemia TF-1 cell line to model erythroid maturation and exposed them to varying doses of IL-6 over six days. At 10 ng/ml, IL-6 significantly repressed erythropoietin-dependent TF-1 erythroid maturation. While IL-6 did not decrease the expression of genes associated with hemoglobin synthesis, we observed impaired hemoglobin synthesis as demonstrated by decreased benzidine staining. We also observed that IL-6 down regulated expression of the gene SLC4a1 which is expressed late in erythropoiesis. Those findings suggested that IL-6-dependent inhibition of hemoglobin synthesis might occur. We investigated the impact of IL-6 on mitochondria. IL-6 decreased the mitochondrial membrane potential at all treatment doses, and significantly decreased mitochondrial mass at the highest dose. Our studies indicate that IL-6 may impair mitochondrial function in maturing erythroid cells resulting in impaired hemoglobin production and erythroid maturation. Our findings may indicate a novel pathway of action for IL-6 in the anemia of inflammation, and draw attention to the potential for new therapeutic targets that affect late erythroid development.

系統性炎症反應的治療決策



系統性炎症反應的治療決策



壞到骨髓的**非再生性貧血**

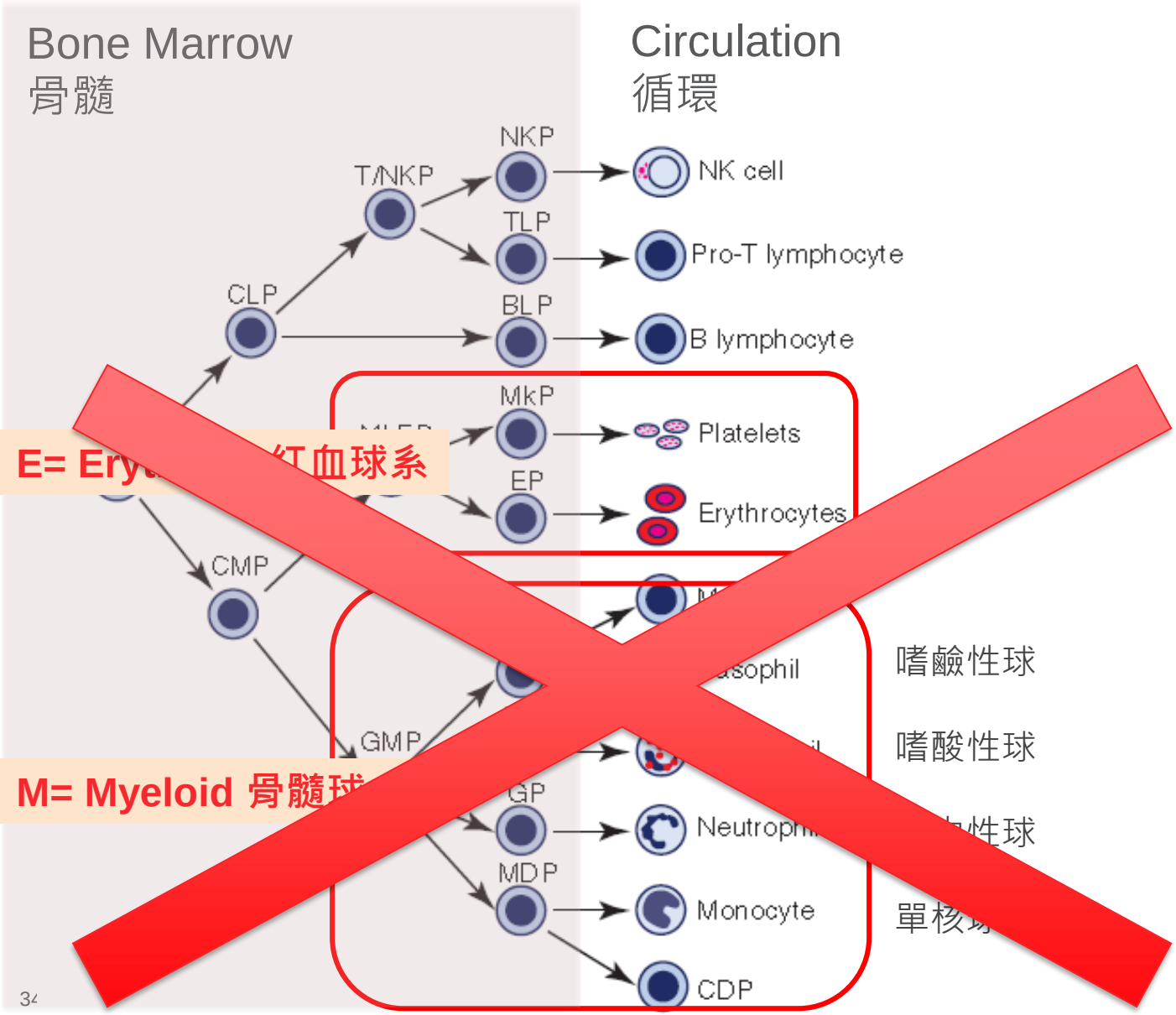
救看看!!!

非再生性貧血的病因思考

- **骨髓的抑制**
  - 系統性炎症
  - 艾莉希體感染
  - 缺鐵
  - 肝功不良
- **缺乏造血的訊號**
  - 慢性腎病 (EPO缺乏)
- **缺乏造血細胞**
  - 自體免疫 (Pure red cell aplasia)
  - 骨髓壞死 (病毒感染 Ex. Parvo)
  - 中毒 (藥物、Estrogen、中金屬)
  - 腫瘤轉移到骨髓
- **癌化**
  - 血球生成不良 (dysplasia)
  - 血液腫瘤

確診 or 預後評估:
✓往往需要考慮骨髓採樣。

骨髓纖維化、壞死



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骨髓纖維化、壞死 的樣貌

骨髓內前驅細胞(progenitor cells)量的評估

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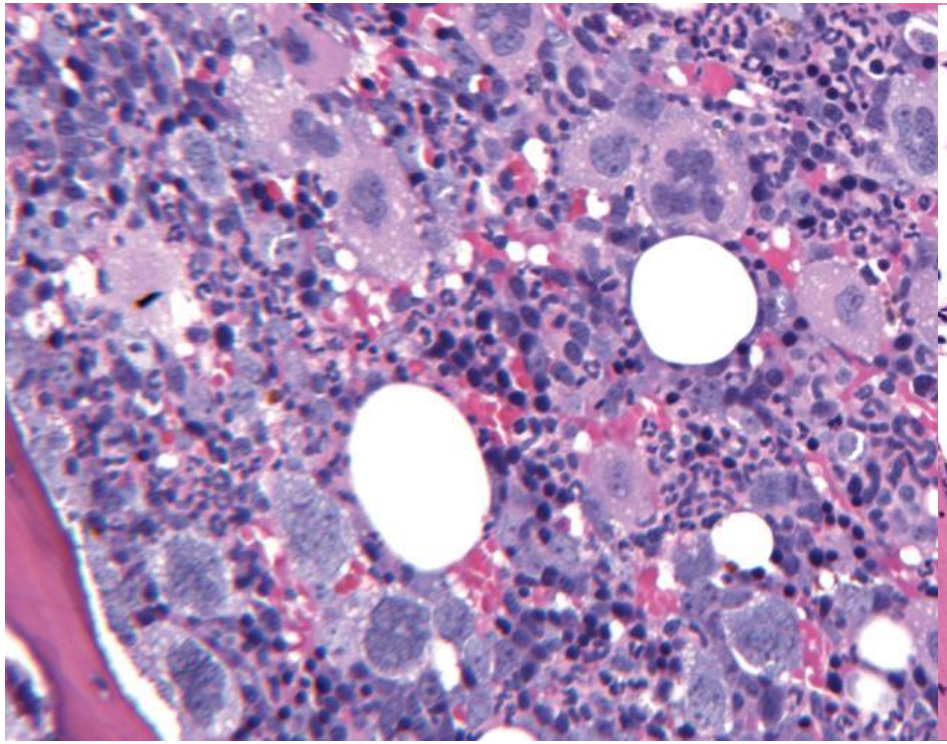
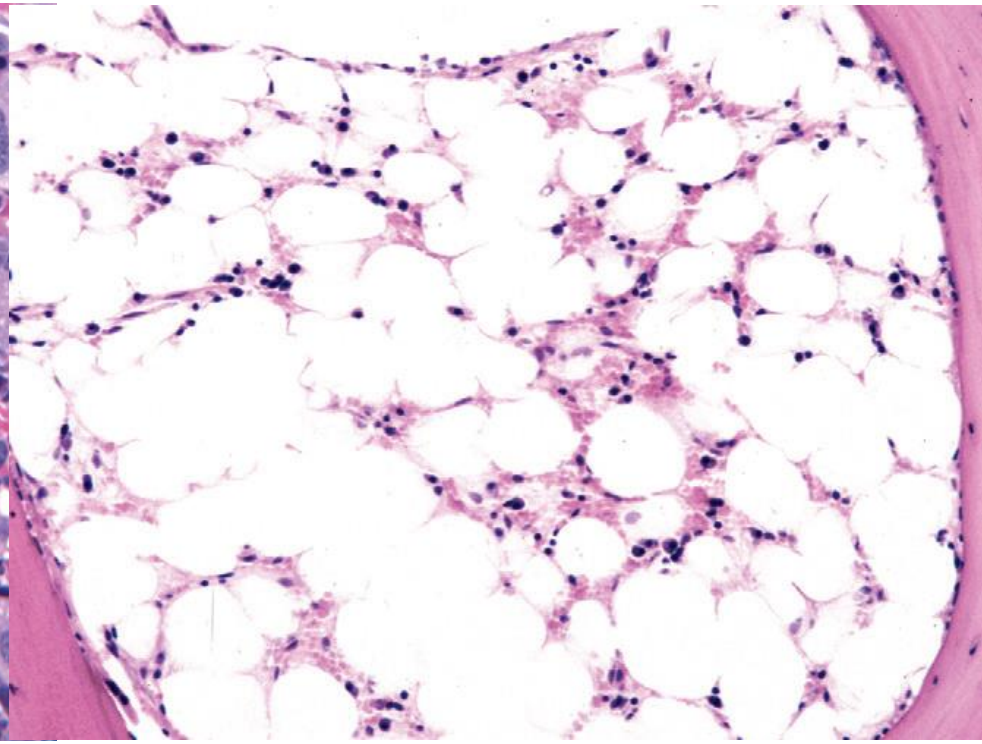


細胞量多

Hypercellular core bone marrow biopsy from a dog with iron-deficiency anemia. Megakaryocytic hyperplasia resulted in a peripheral thrombocytosis. H&E stain.



細胞量少

Hypocellular bone marrow aspirate smears and core biopsy sections from dogs. Generalized hypocellularity in a section from a bone marrow core biopsy collected from a dog with an idiopathic aplastic anemia. H&E stain.

Case
一隻台灣犬的故事

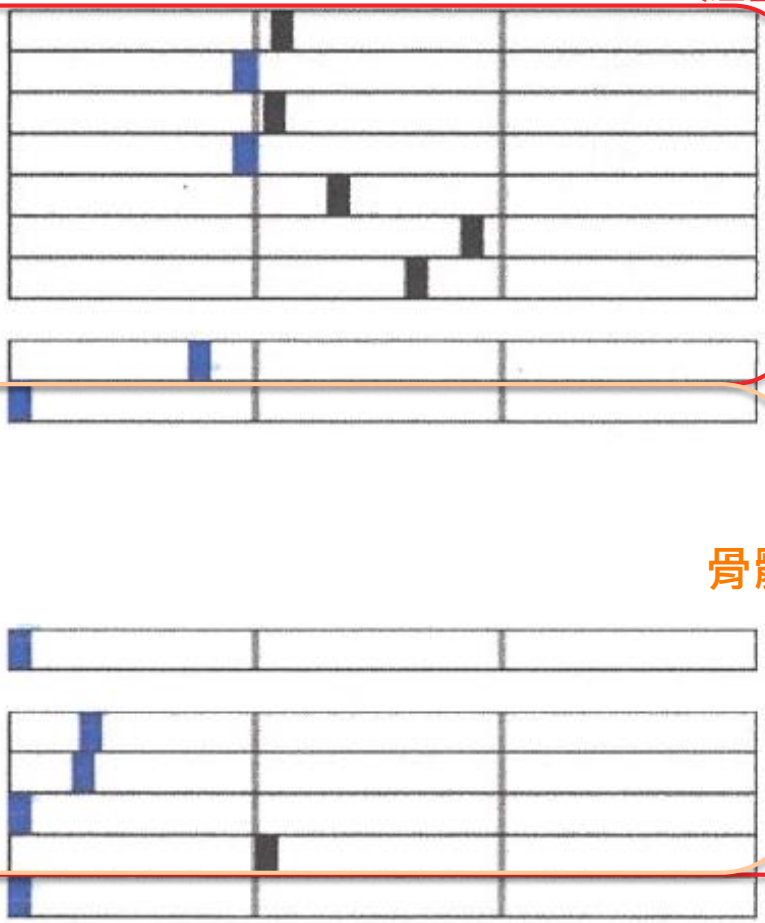
Case. 台灣犬 小黑

- 八歲. 雄性 (未結紮)
- 精神食慾佳。
- 體溫正常
- 牙齦一直滲血，懷疑嘴巴有傷口，想要進行洗牙。

Case. 台灣犬 小黑

ProCyte Dx (2016年5月9日 上午 11:34)

RBC	6.01 M/μL	5.65 - 8.87	
HCT	36.8 %	37.3 - 61.7	低
HGB	13.7 g/dL	13.1 - 20.5	
MCV	61.2 fL	61.6 - 73.5	低
MCH	22.8 pg	21.2 - 25.9	
MCHC	37.2 g/dL	32.0 - 37.9	
RDW	19.0 %	13.6 - 21.7	
%RETIC	0.1 %		
RETIC	7.8 K/μL	10.0 - 110.0	低
WBC	0.75 K/μL	5.05 - 16.76	低
%NEU	* 37.3 %		
%LYM	* 56.0 %		
%MONO	* 6.7 %		
%EOS	0.0 %		
%BASO	0.0 %		
NEU	* 0.28 K/μL	2.95 - 11.64	低
BAND	* 疑似		
LYM	* 0.42 K/μL	1.05 - 5.10	低
MONO	* 0.05 K/μL	0.16 - 1.12	低
EOS	0.00 K/μL	0.06 - 1.23	低
BASO	0.00 K/μL	0.00 - 0.10	
PLT	* 0 K/μL	148 - 484	低
MPV	--.-- fL	8.7 - 13.2	
PDW	--.-- fL	9.1 - 19.4	
PCT	--.-- %	0.14 - 0.46	



紅血球系

骨髓系

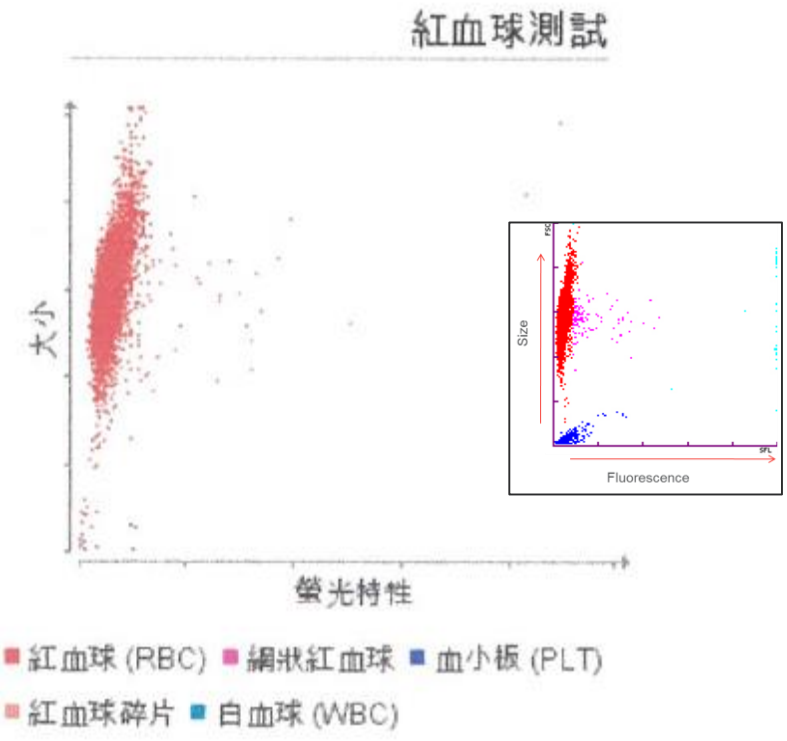
紅血球系

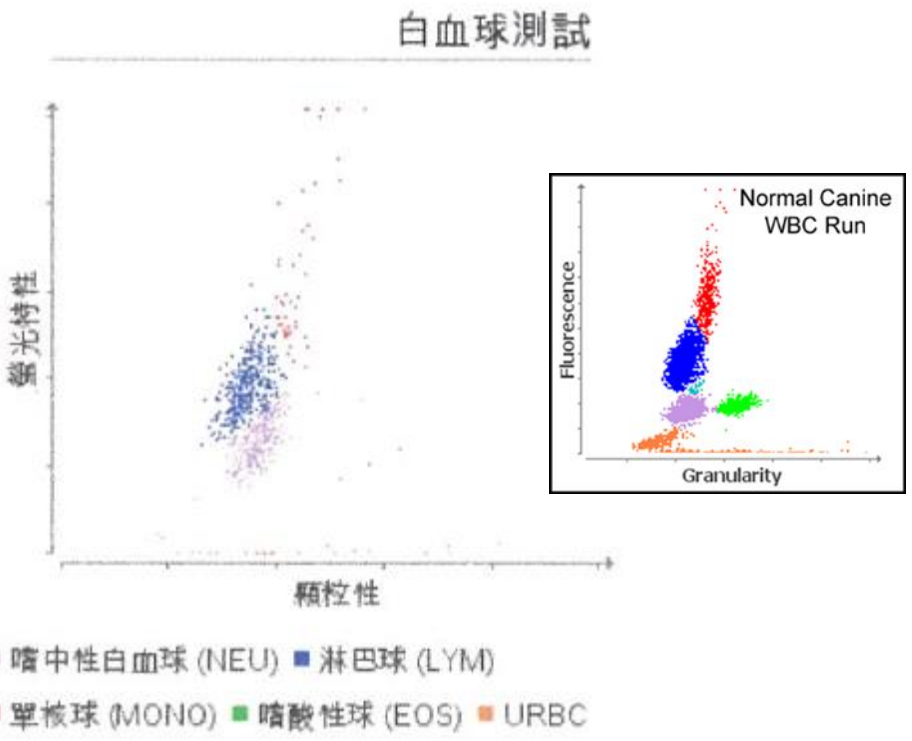
疑似有帶狀嗜中性球(BAND)

Case. 台灣犬 小黑

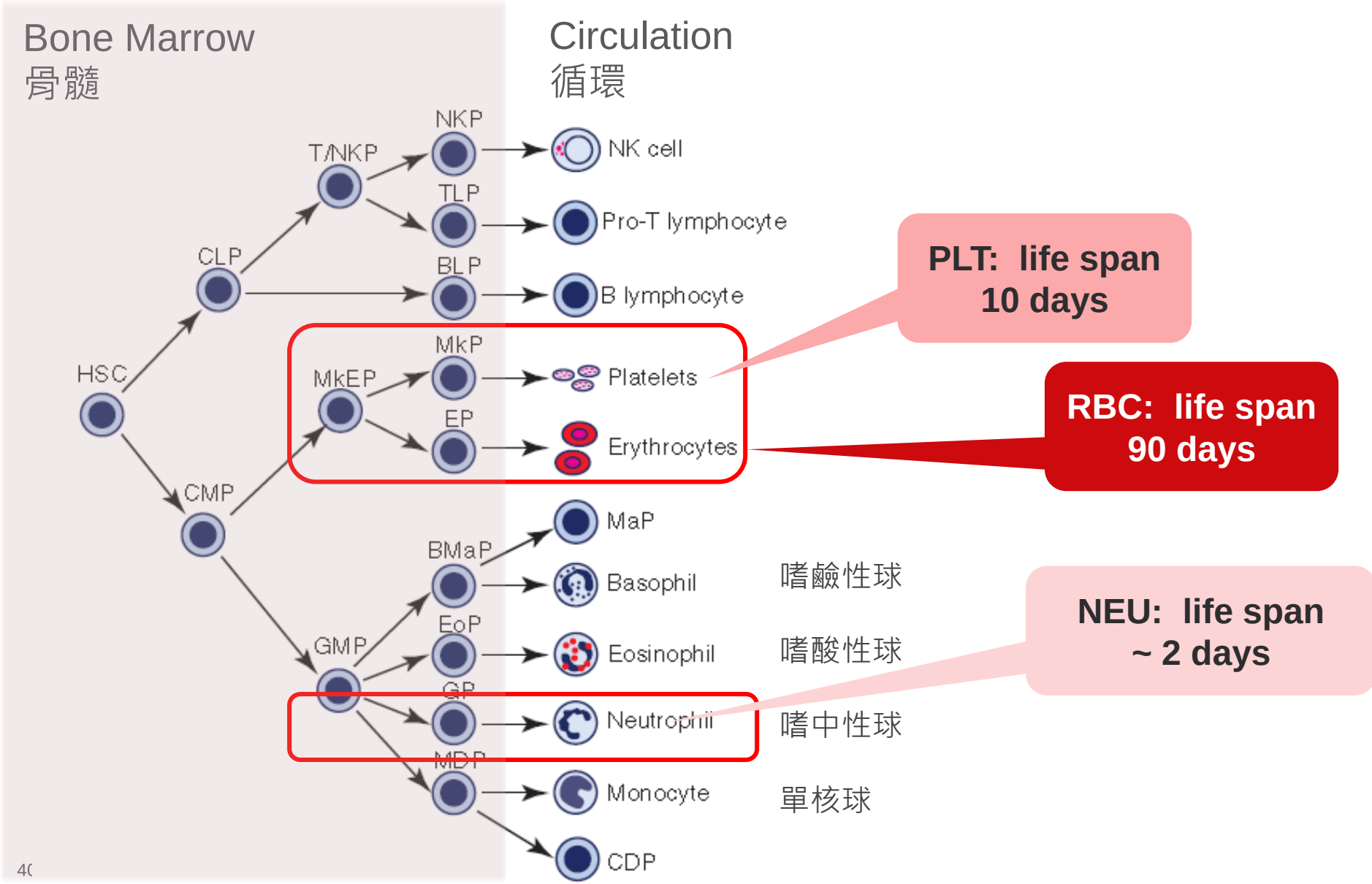
- **SNAP 4Dx Plus:** EC (-) , AP(-)

- **TP**= 6.8 g/dL
- **ALB**= 2.8 g/dL
- **GLO**= 4.0 g/dL





細胞的生命週期反映出骨髓的狀態



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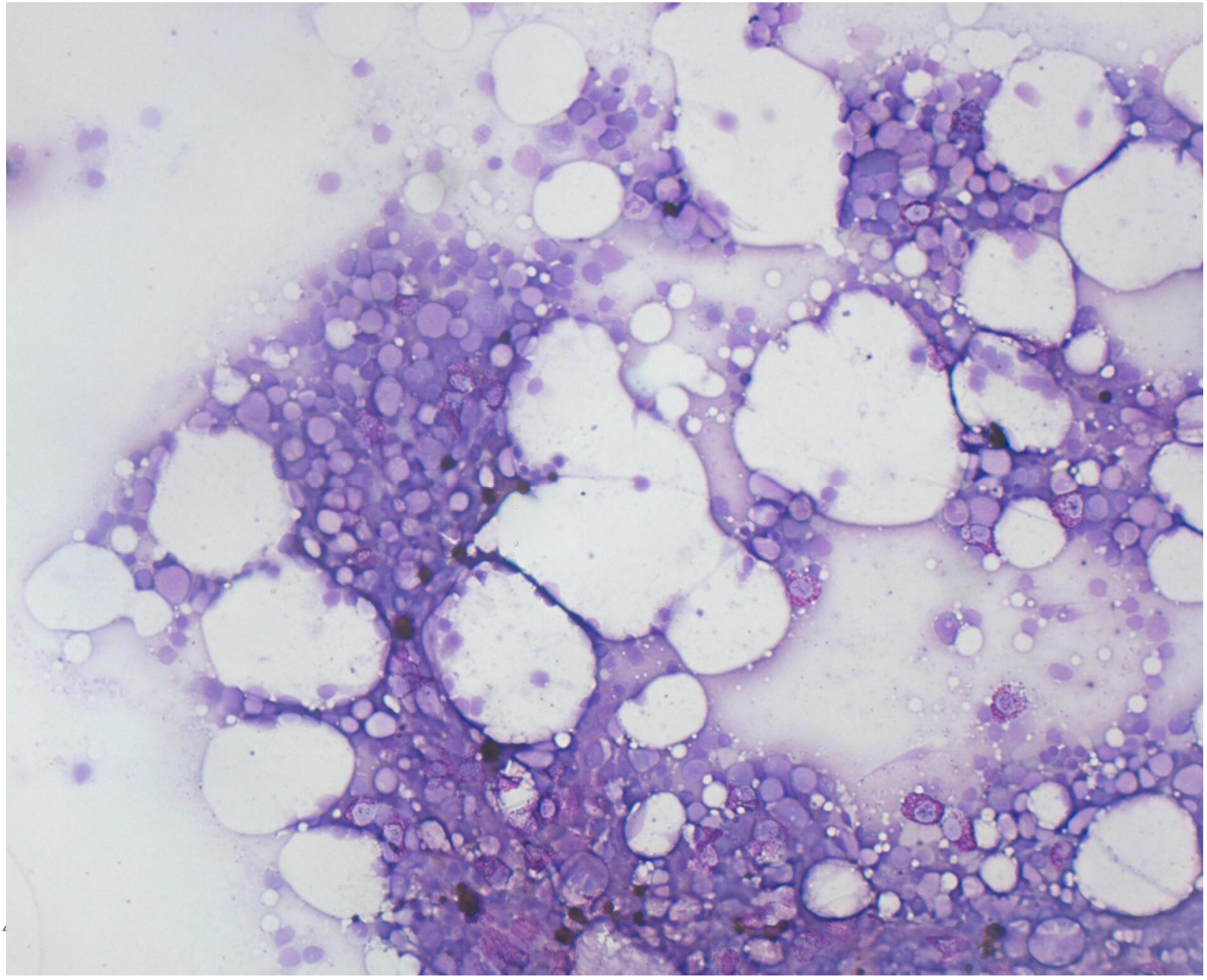
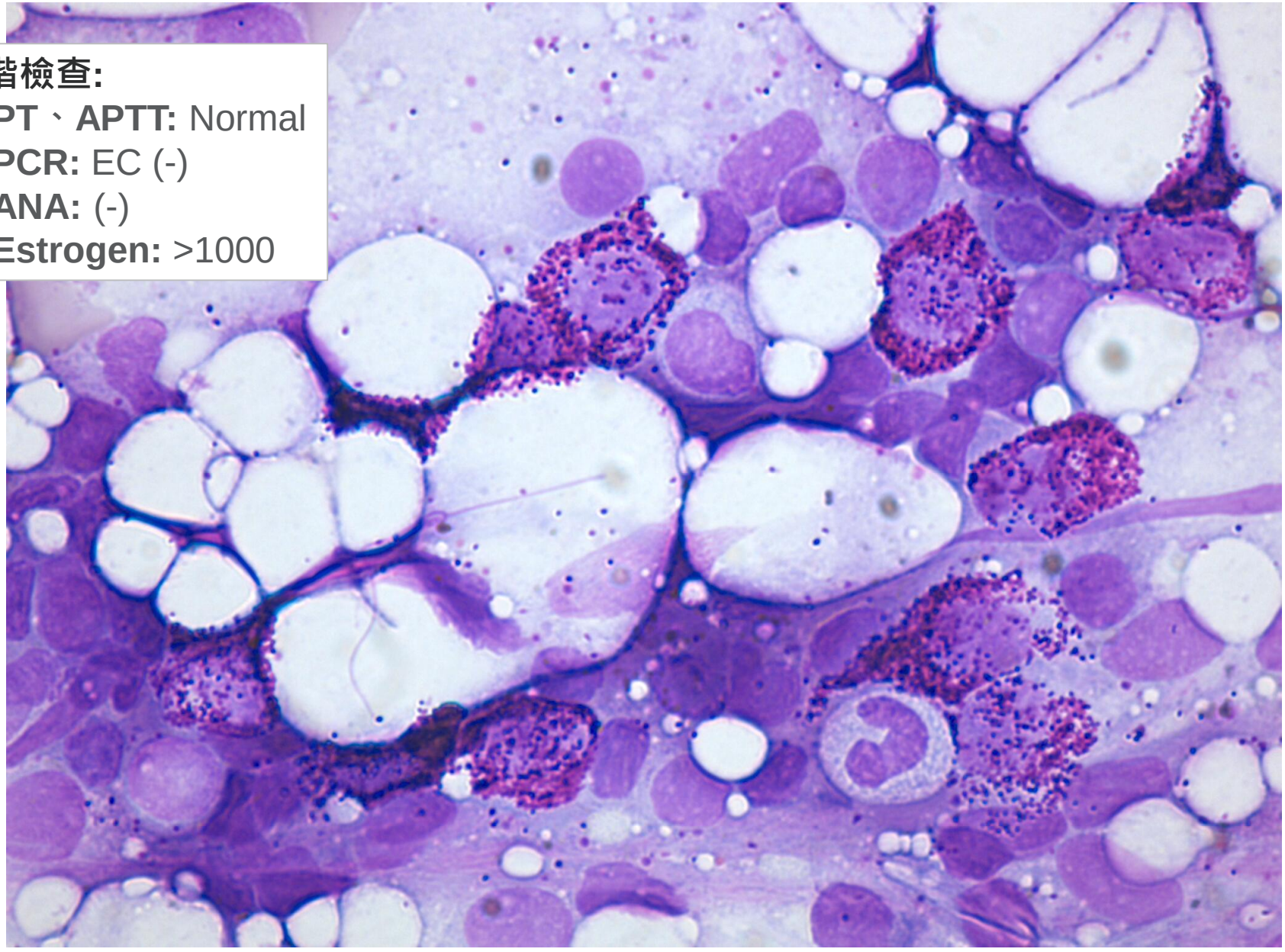
Case. 台灣犬 小黑 骨髓檢查發現



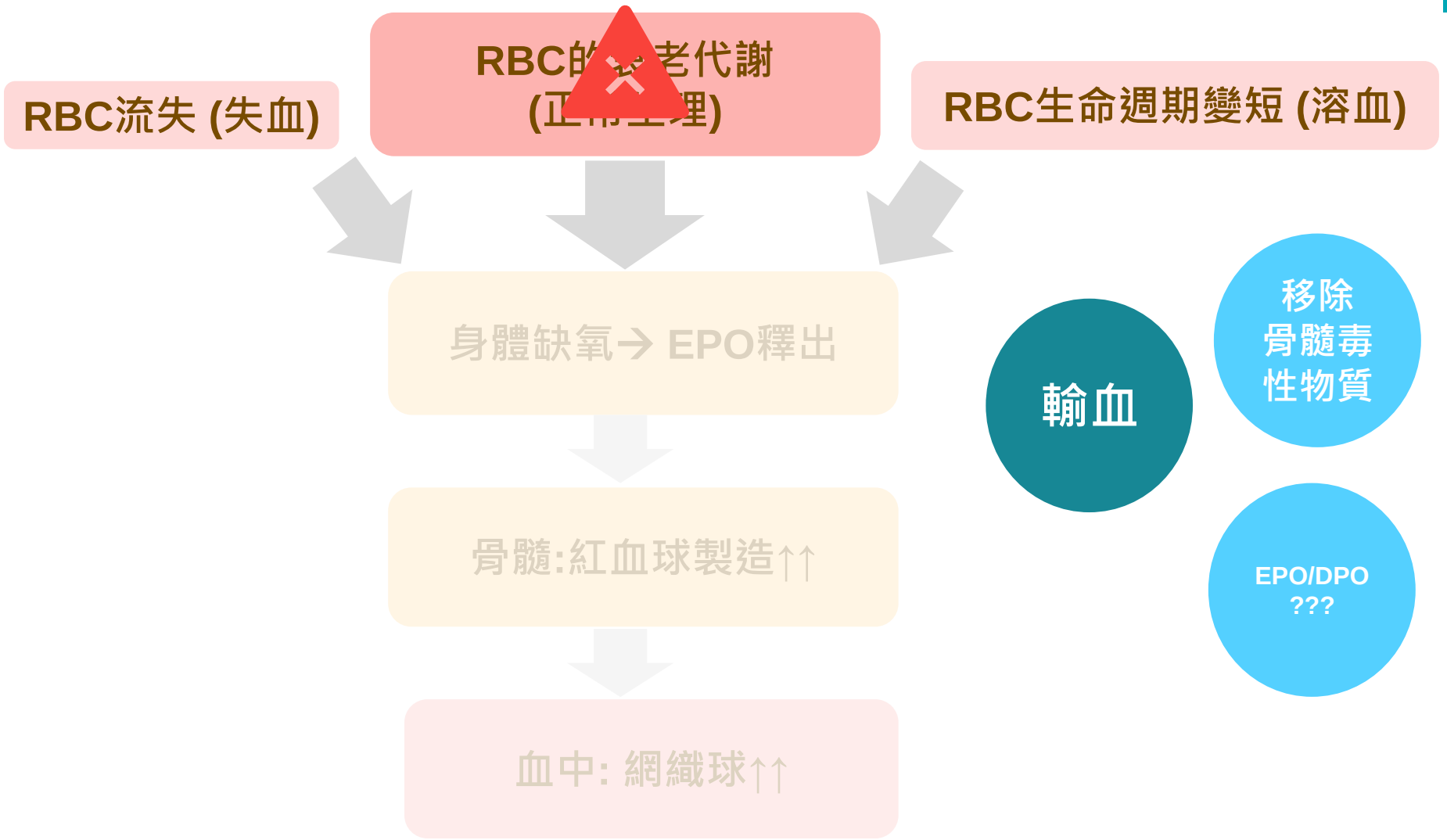
Case. 台灣犬 小黑 骨髓檢查發現

進階檢查:

- **PT、APTT:** Normal
- **PCR:** EC (-)
- **ANA:** (-)
- **Estrogen:** >1000



小黑的治療決策



4.假如小黑順利活下來...
我們應如何追蹤他的預後???(多選)

A.追蹤 血小板(PLT)數量

B.追蹤 PCV 或 HCT

C.追蹤 嗜中性球(NEU) 絕對數量

D.追蹤 網織球(Ret) 絕對數量

假如小黑順利活下來...
我們應如何追蹤他的預後???(多選)

A.追蹤 血小板(PLT)數量

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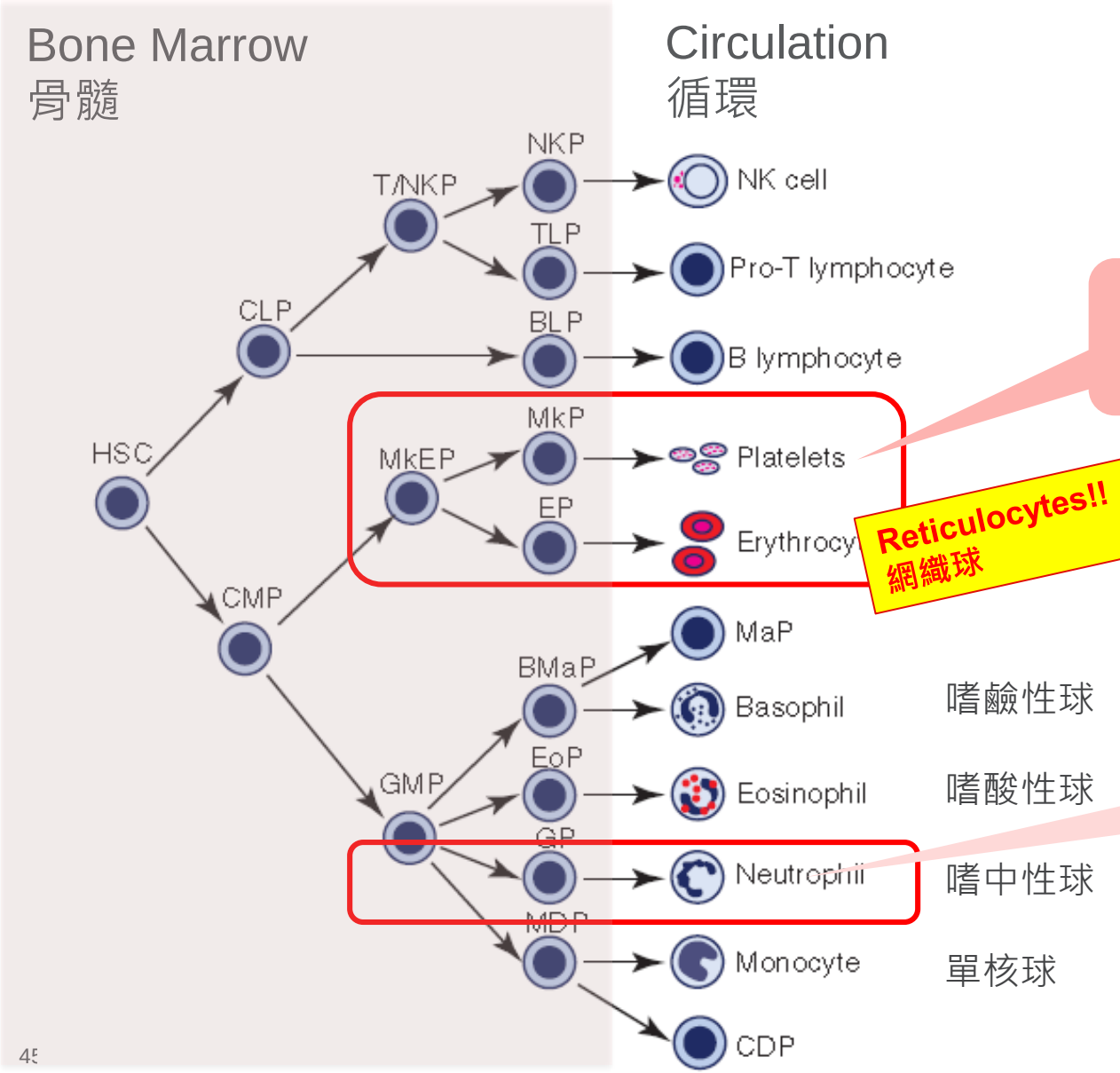
D.追蹤 網織球(Ret) 絕對數量



PLT: life span 10 days

Reticulocytes!! 網織球

RBC: life span 90 days

NEU: life span ~ 2 days

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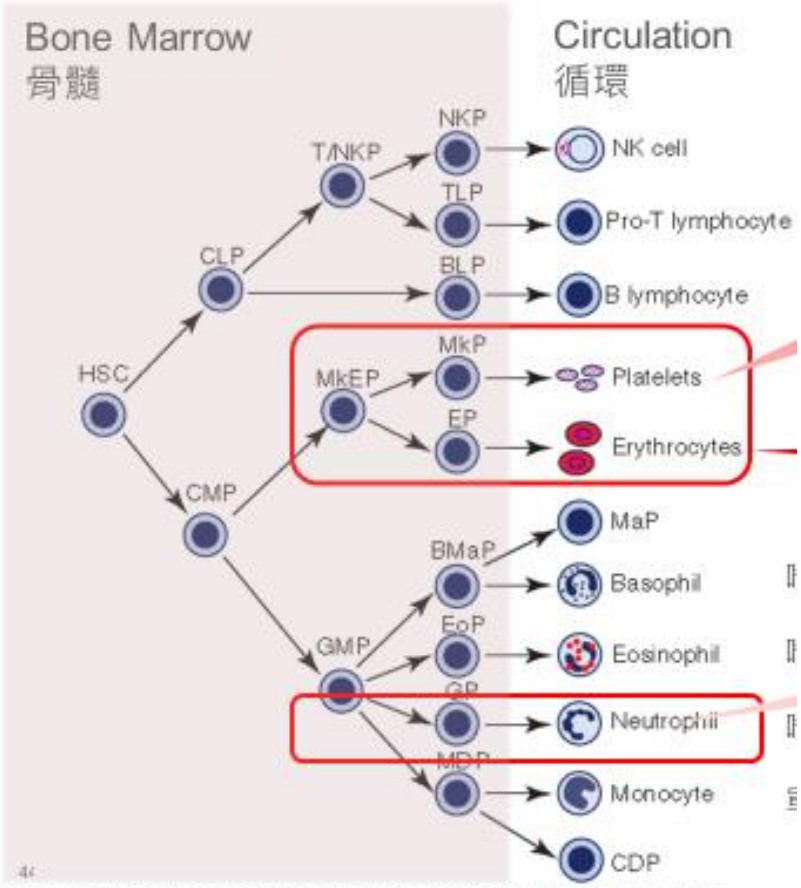
系統性的炎症反應 或 自體免疫

病原或免疫反應
造成一個 或多個細胞系 生成不良



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Case
一隻**柴犬**的故事

Case. 出血斑 柴犬

- 四歲
- 雄性 結紮
- 有預防壁蝨

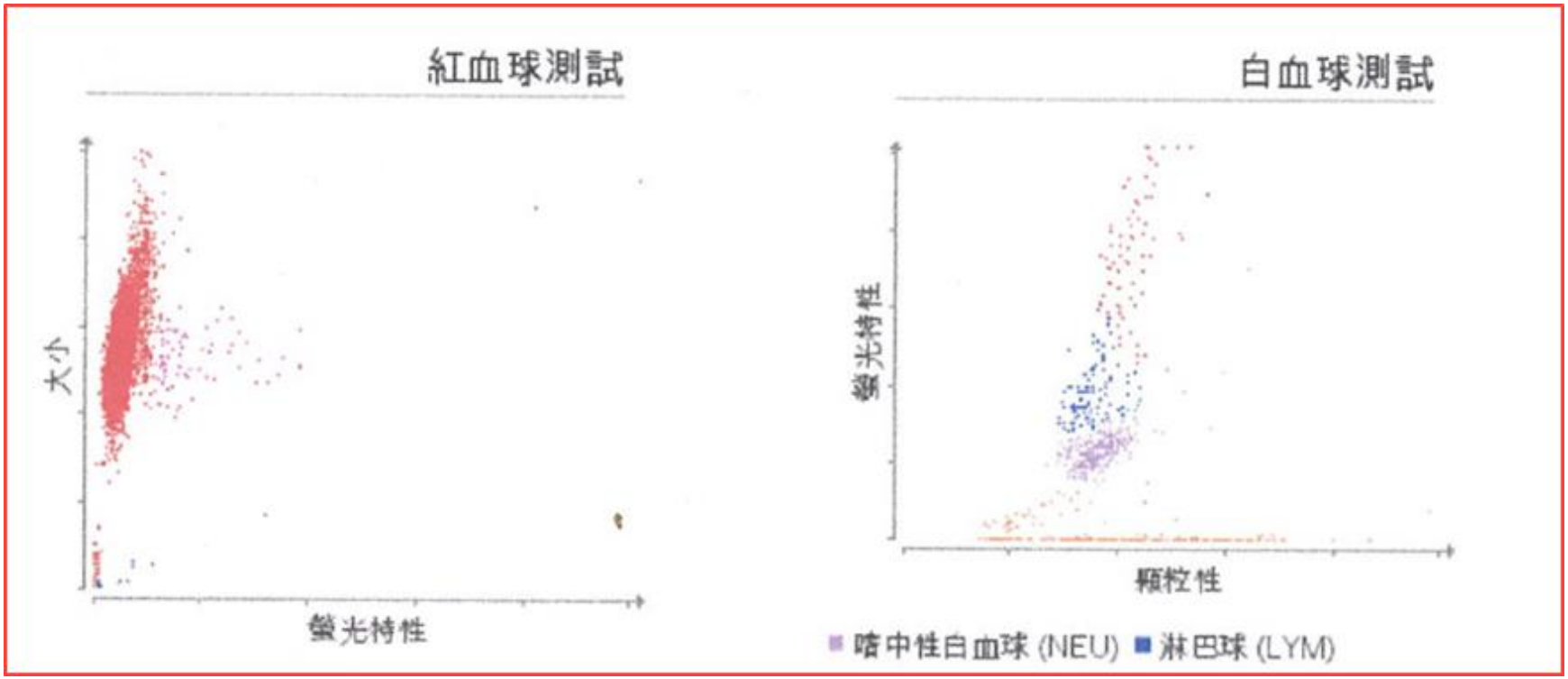
主訴:

- 精神食慾差，血便，全身多發出血斑

理學檢查:

- 體溫: 39.3 C
- 呼吸: 喘

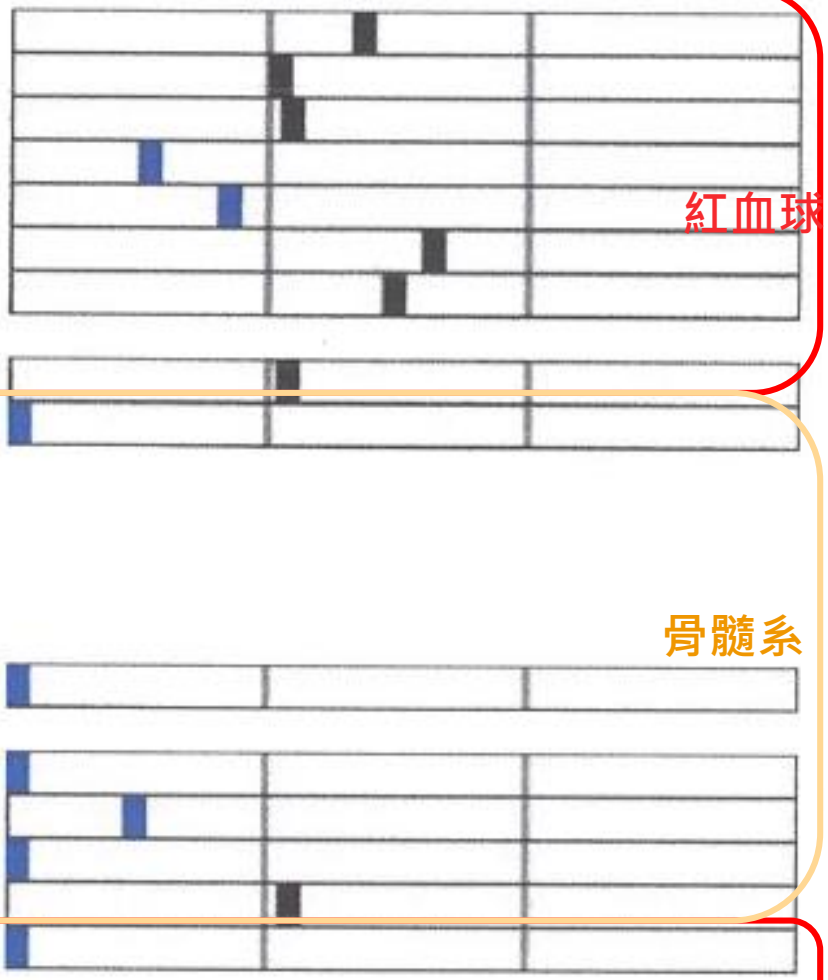
Case. 出血斑 柴犬



Case. 出血斑 柴犬

ProCyte Dx (2016年3月22日 上午 9:06)

RBC	6.84 M/μL	5.65 - 8.87	
HCT	38.6 %	37.3 - 61.7	
HGB	13.8 g/dL	13.1 - 20.5	
MCV	56.4 fL	61.6 - 73.5	低
MCH	20.2 pg	21.2 - 25.9	低
MCHC	35.8 g/dL	32.0 - 37.9	
RDW	17.6 %	13.6 - 21.7	
%RETIC	0.3 %		
RETIC	18.5 K/μL	10.0 - 110.0	
WBC	0.57 K/μL	5.05 - 16.76	低
%NEU	* 64.9 %		
%LYM	* 19.3 %		
%MONO	* 14.0 %		
%EOS	0.0 %		
%BASO	1.8 %		
NEU	* 0.37 K/μL	2.95 - 11.64	低
BAND	* 疑似		
LYM	* 0.11 K/μL	1.05 - 5.10	低
MONO	* 0.08 K/μL	0.16 - 1.12	低
EOS	0.00 K/μL	0.06 - 1.23	低
BASO	0.01 K/μL	0.00 - 0.10	
PLT	* 0 K/μL	148 - 484	低
MPV	--.-- fL	8.7 - 13.2	
PDW	--.-- fL	9.1 - 19.4	
PCT	--.-- %	0.14 - 0.46	



紅血球系

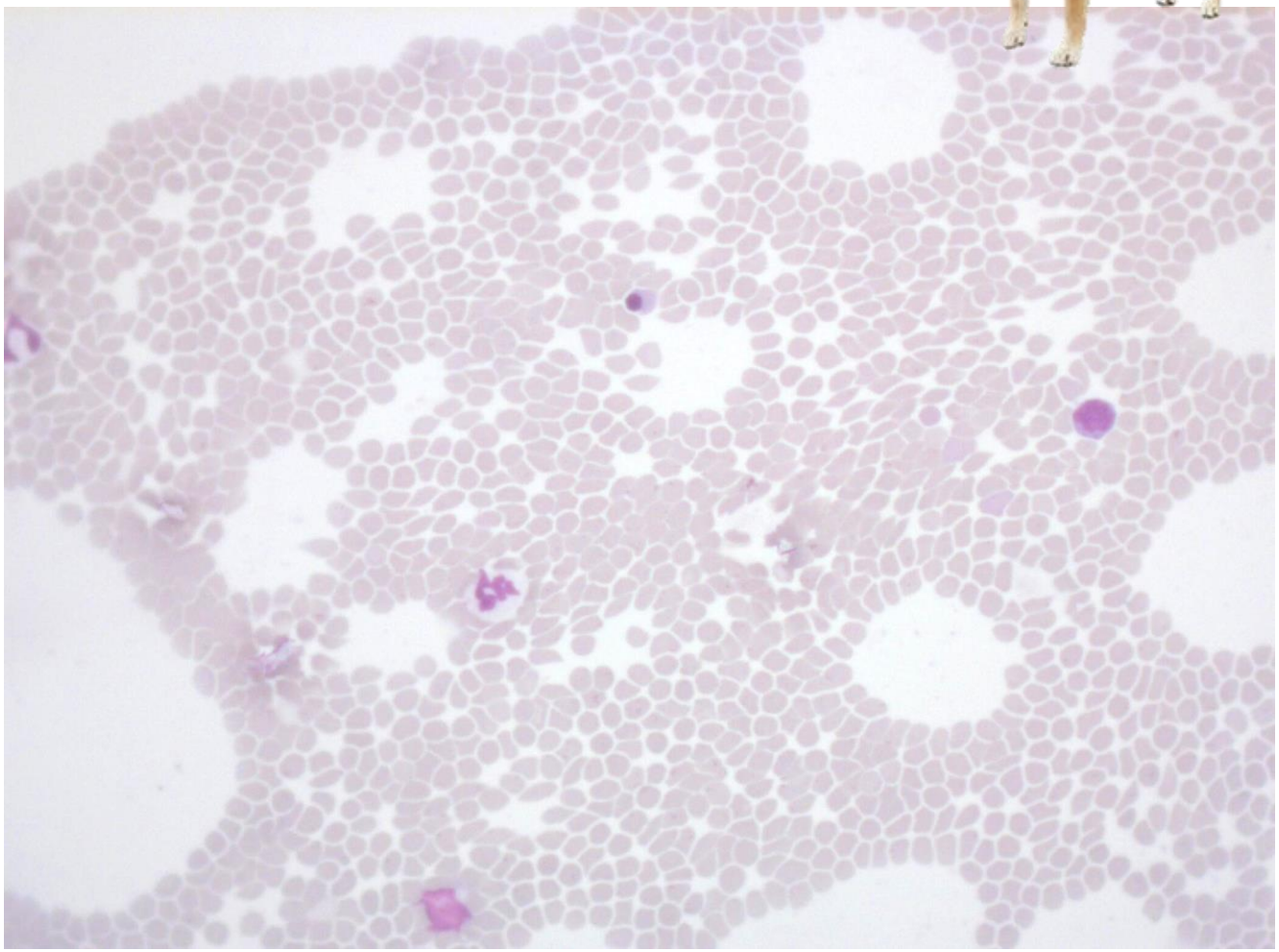
骨髄系

紅血球系

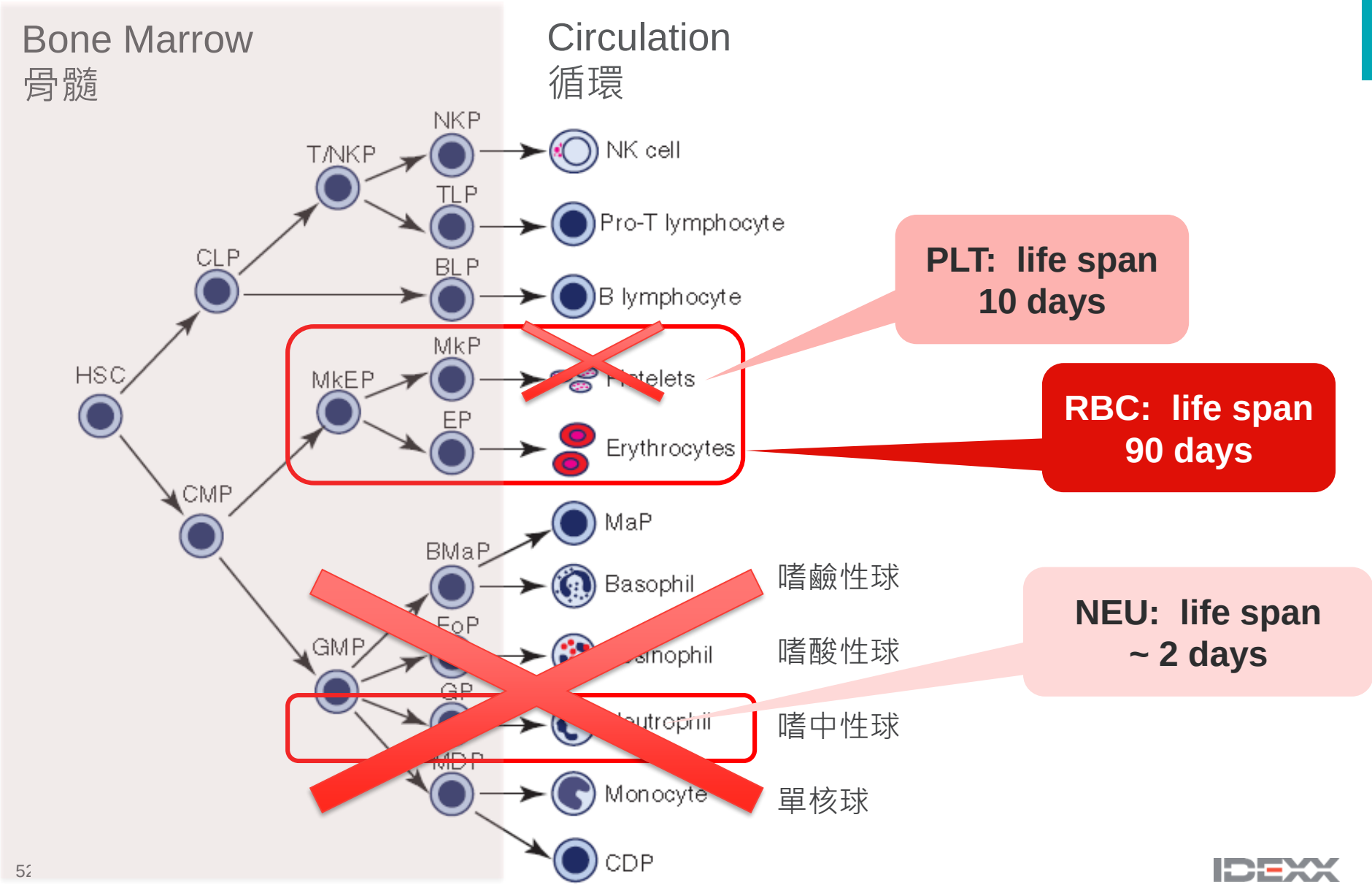
疑似有帯狀嗜中性球(BAND)

Case. 出血斑 柴犬

- 全身多發出血斑
- 嚴重非再生性貧血
- 沒有血小板、NEU 低
- **SNAP 4Dx Plus:** EC+



從血球的表現 推測骨髓的狀況



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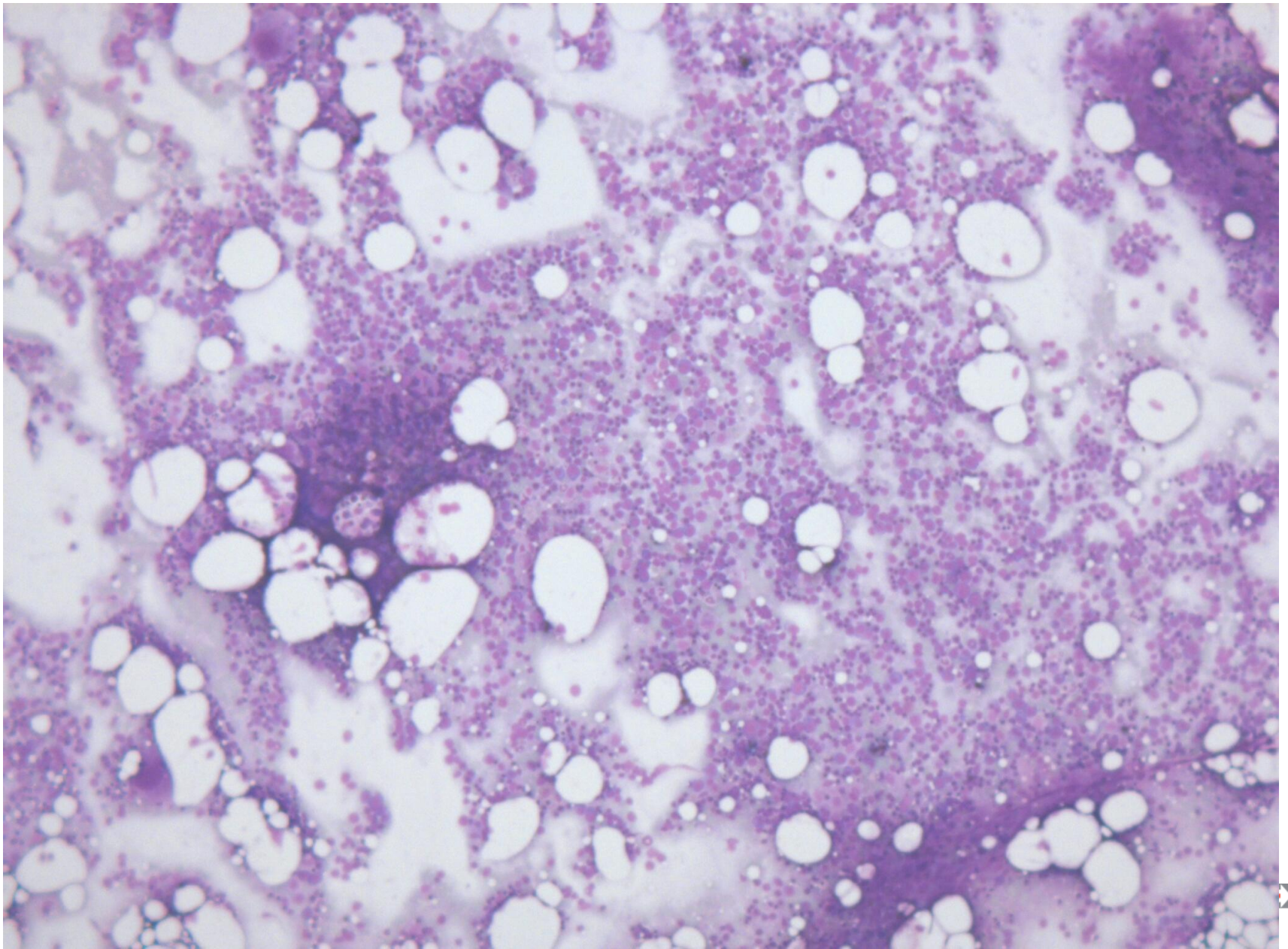
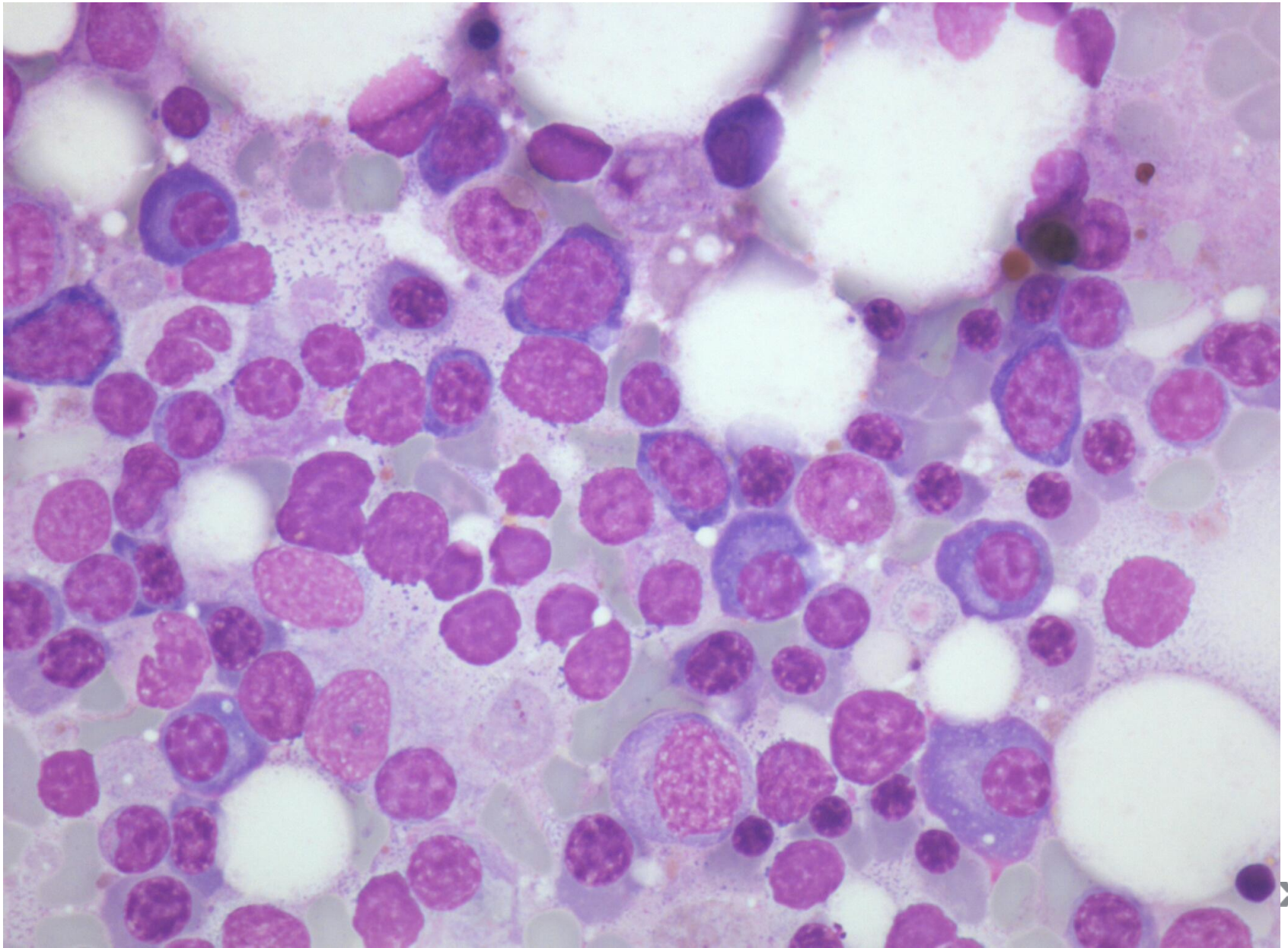
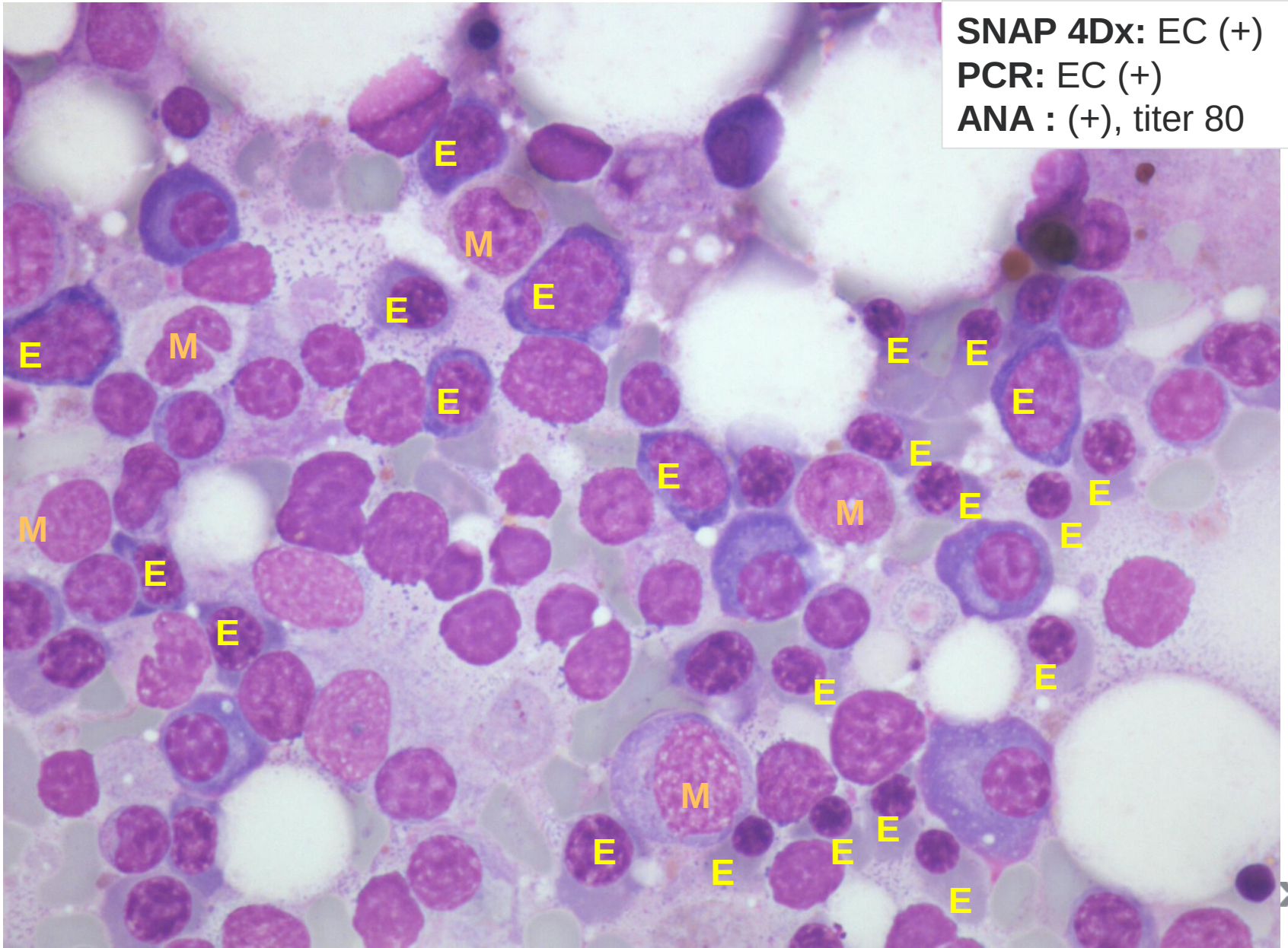
Case. 出血斑 柴犬　骨髓檢查發現



Case. 出血斑 柴犬　骨髓檢查發現

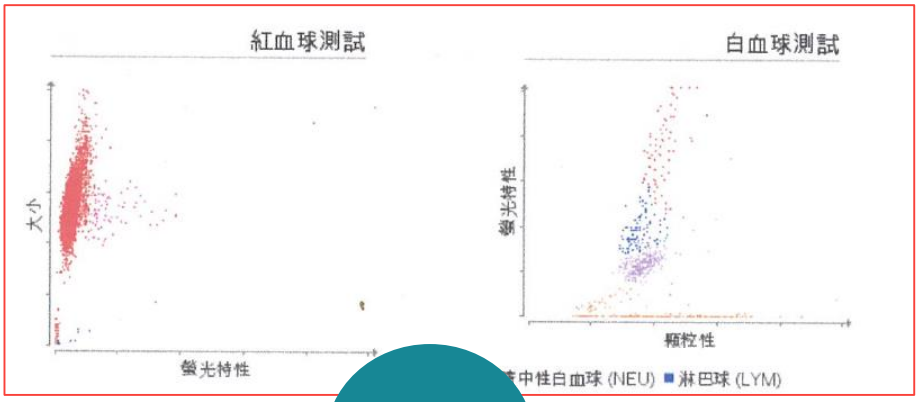


Case. 出血斑 柴犬 骨髓檢查發現



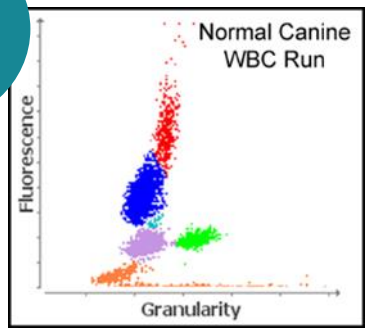
SNAP 4Dx: EC (+)
PCR: EC (+)
ANA : (+), titer 80

柴犬 的治療與追蹤

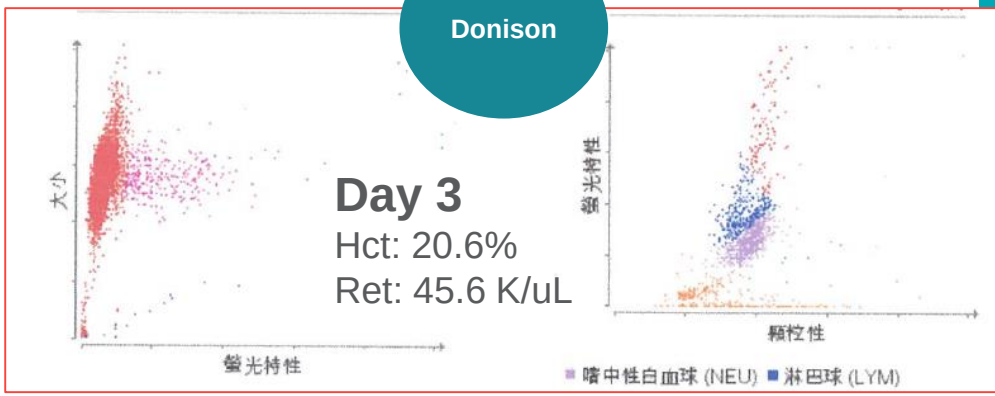


Doxy

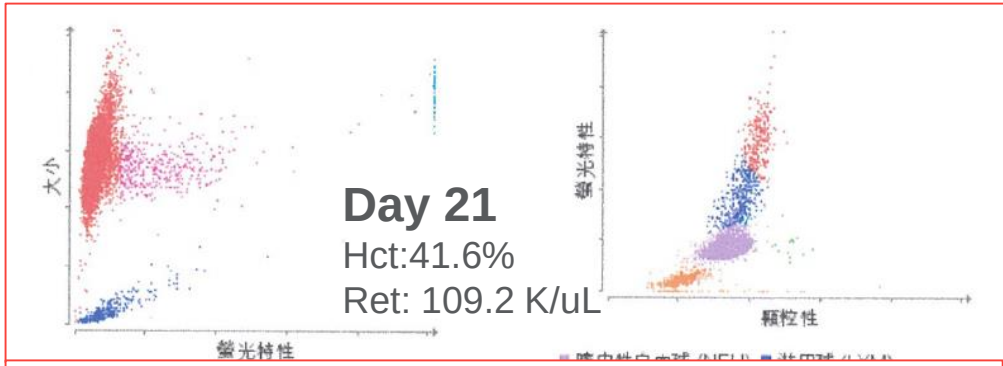
Day 1
Hct: 38.6%
Ret: 18.5 K/uL
PLT: 0 K/uL



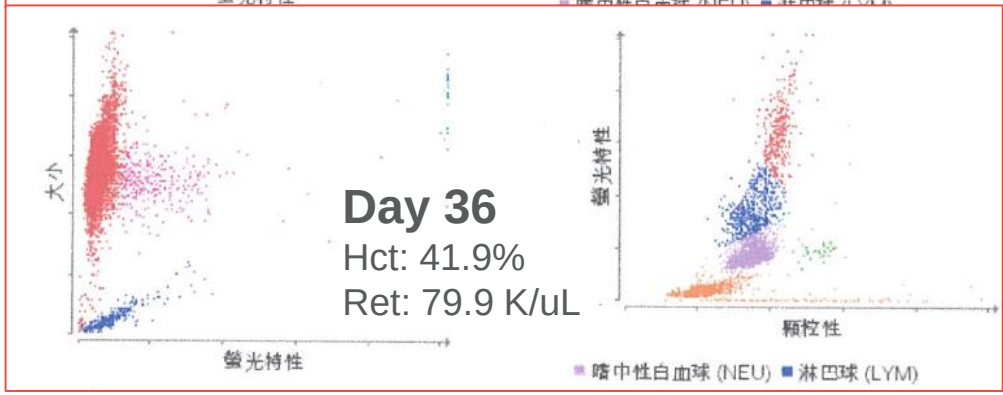
Donison



Day 3
Hct: 20.6%
Ret: 45.6 K/uL



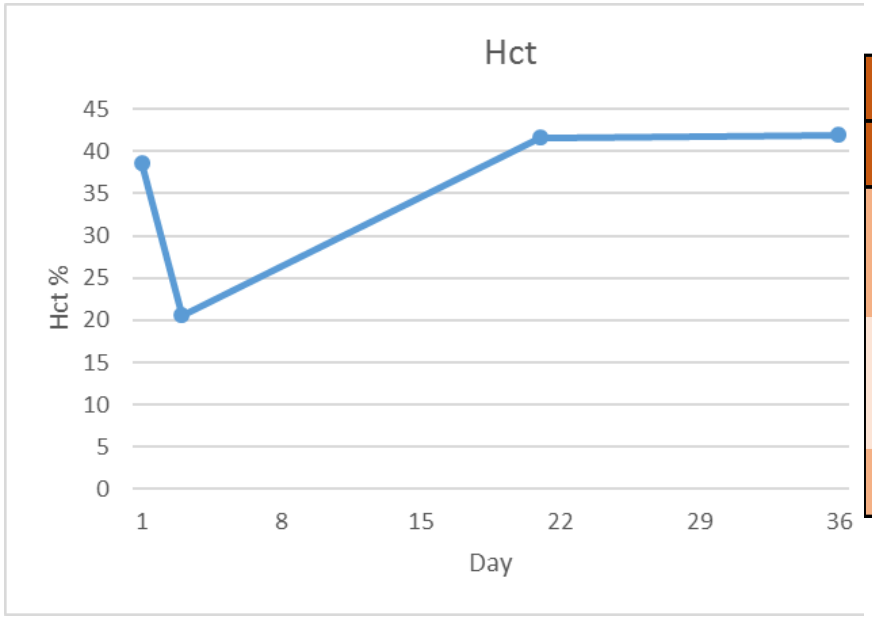
Day 21
Hct:41.6%
Ret: 109.2 K/uL



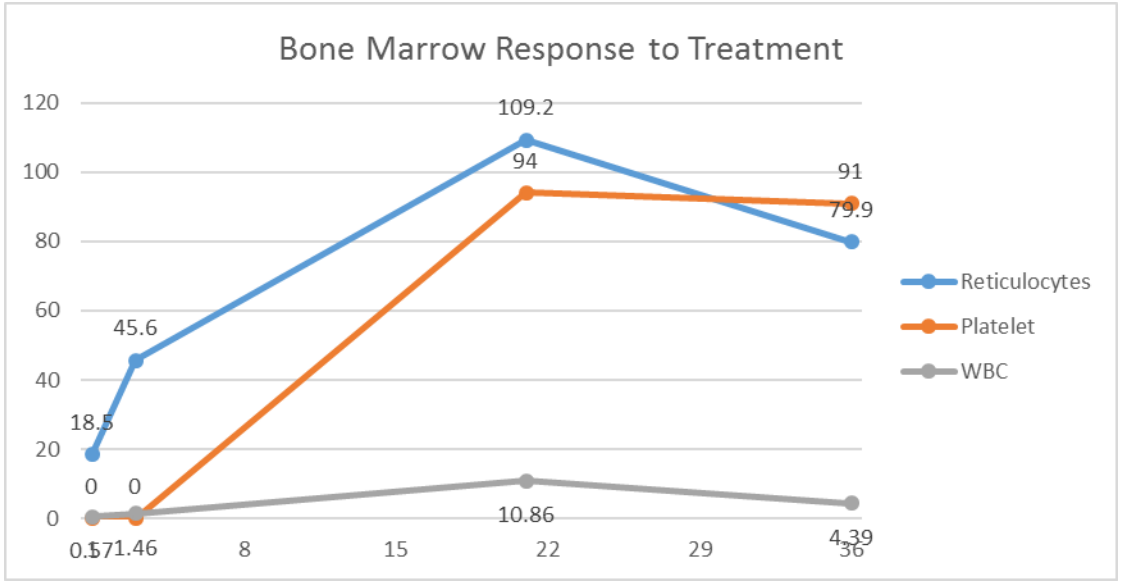
Day 36
Hct: 41.9%
Ret: 79.9 K/uL

Doxycyclin: 5 mg/kg (3/22-5/16)
Donison: 0.7 mg/kg bid (3/24 ~)
4/11 Start Tapering
5/5 Taper for 2 more wk
5/16 confirmed PCR (-)

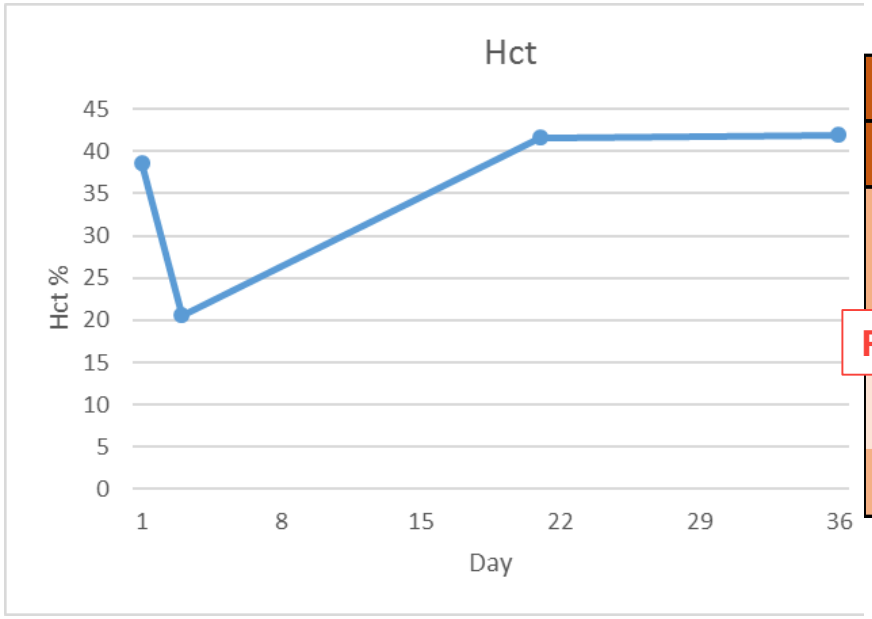
柴犬 的治療與追蹤



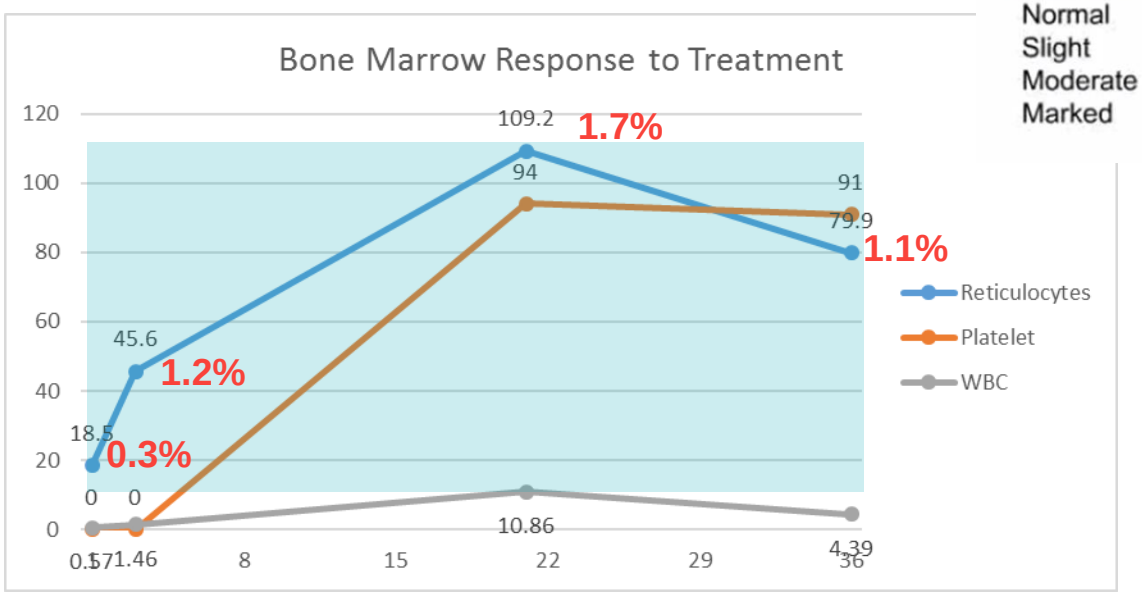
Date	22-Mar	24-Mar	11-Apr	16-May
Day	1	3	21	36
Hct	38.6	20.6	41.6	41.9
Ret	18.5	45.6	109.2	79.9
WBC	0.57	1.46	10.86	4.39
Neu			10.5	3.35
PLT	0	0	94	91



追蹤: 網織球 絕對數量 vs 網織球%



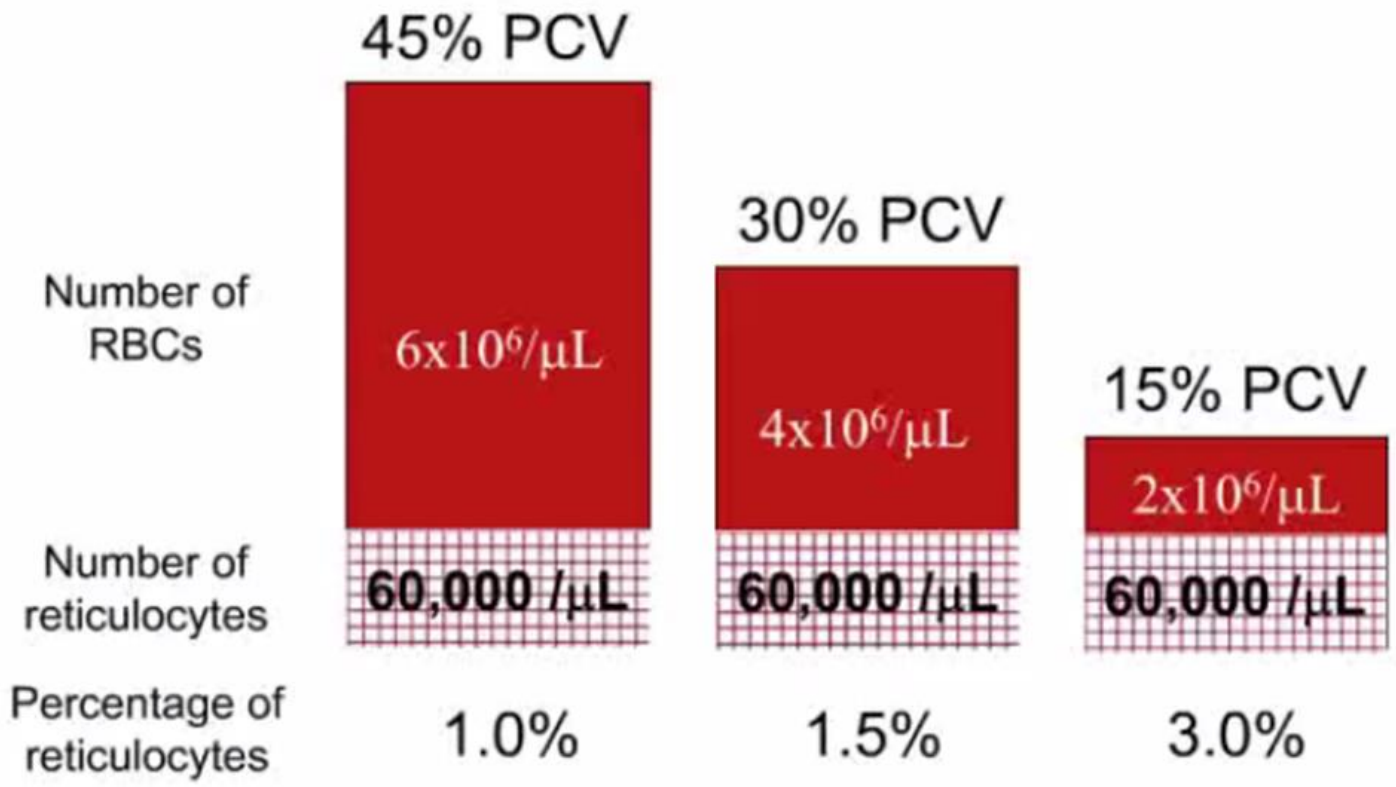
Date	22-Mar	24-Mar	11-Apr	16-May
Day	1	3	21	36
Hct	38.6	20.6	41.6	41.9
Ret	18.5	45.6	109.2	79.9
RET %	0.3%	1.2%	1.7%	1.1%
Neu			10.5	3.35
PLT	0	0	94	91



Degree of Stimulation	Dogs	Cats
Normal	1%	0-0.4%
Slight	1–4%	0.5-2.0%
Moderate	5–20%	3-4%
Marked	21–50%	>5%

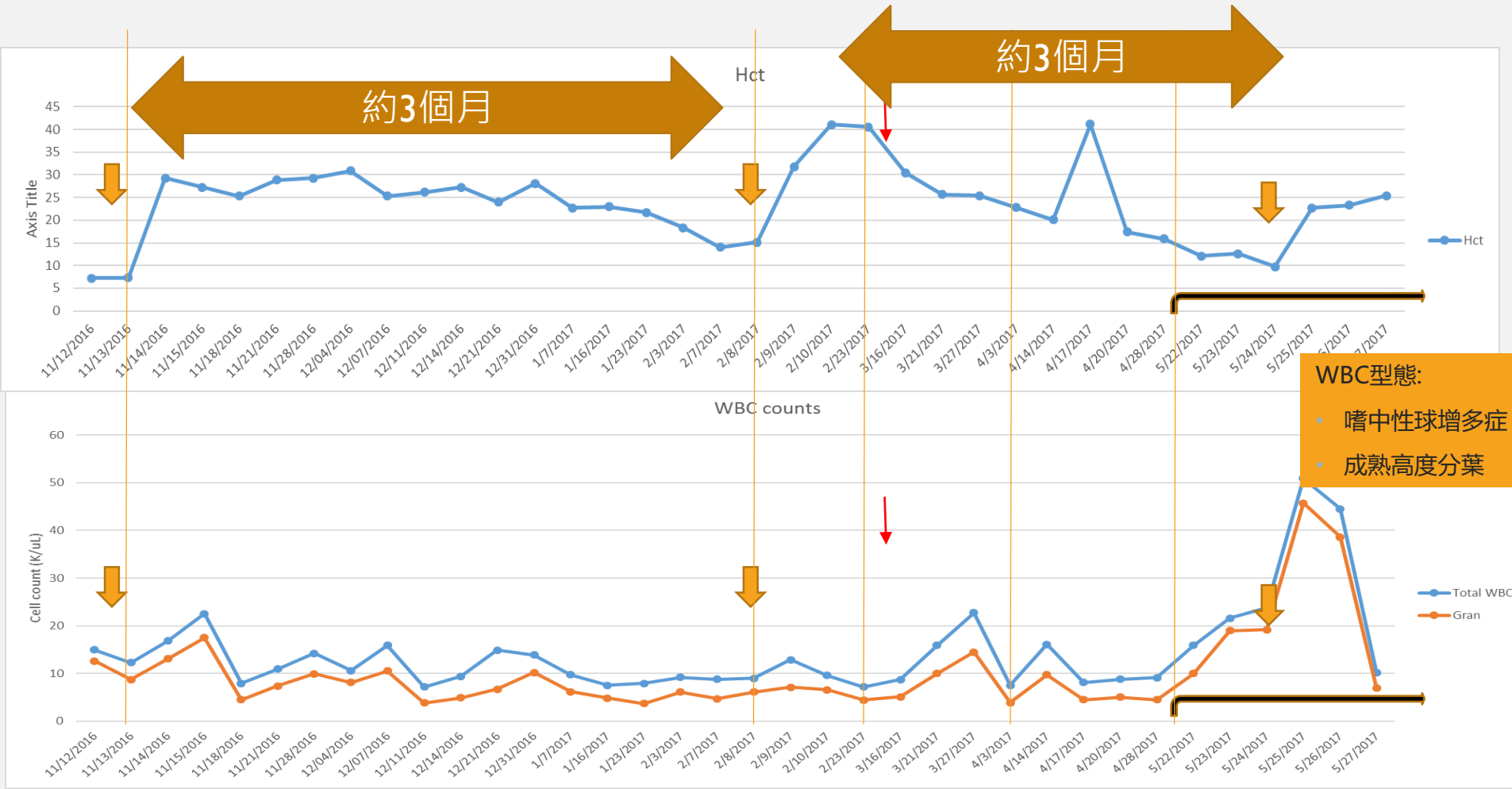
追蹤: 網織球 絕對數量 vs 網織球%

絕對數量是比較客觀的**骨髓反應評估**指標!!!



來看看我們的神祕案例

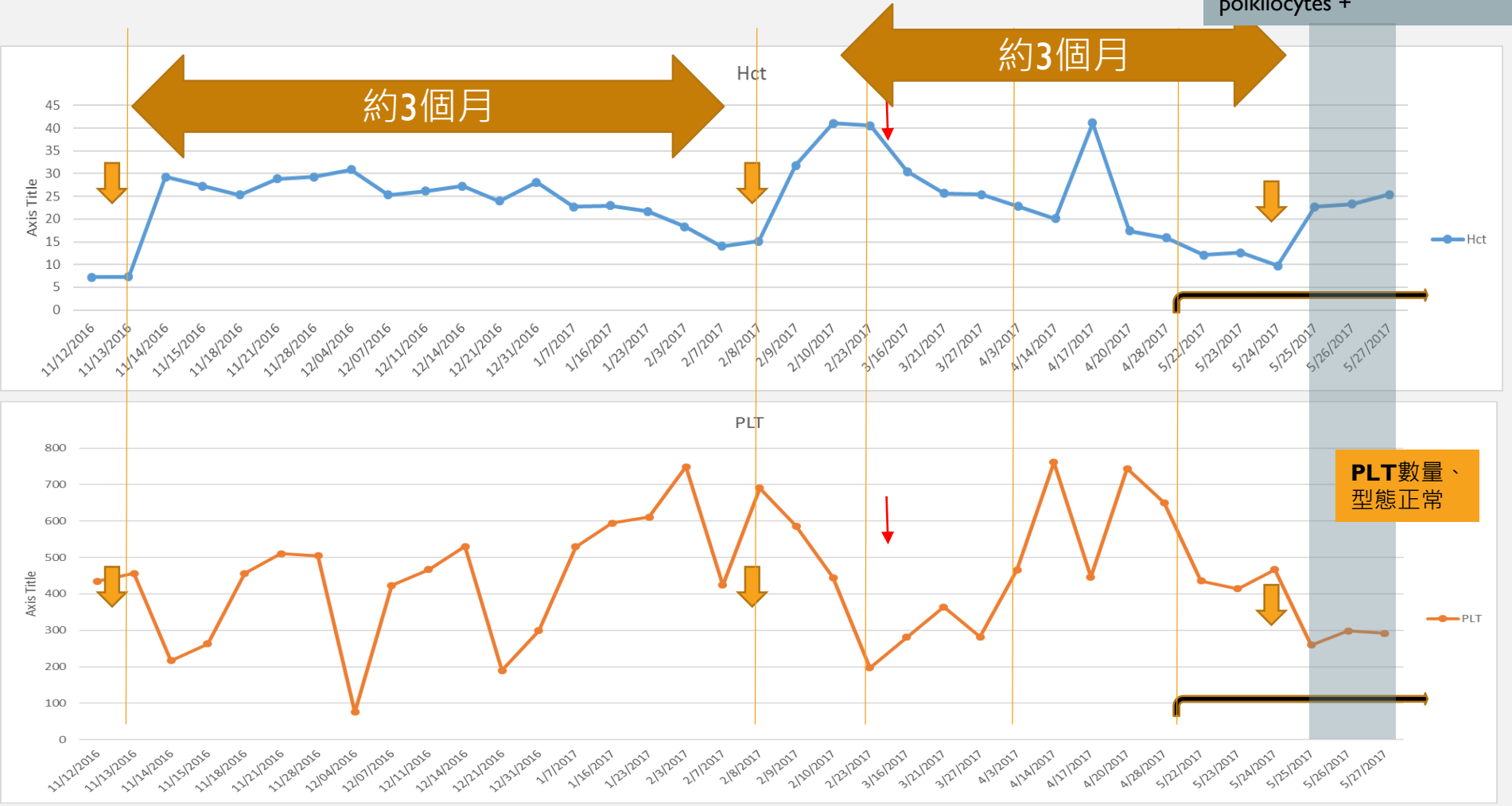
神秘案例: 貧血狀況的長期觀測



Blood Transfusion. May 8th Stopped giving cyclosporine. Mar 7th OHE

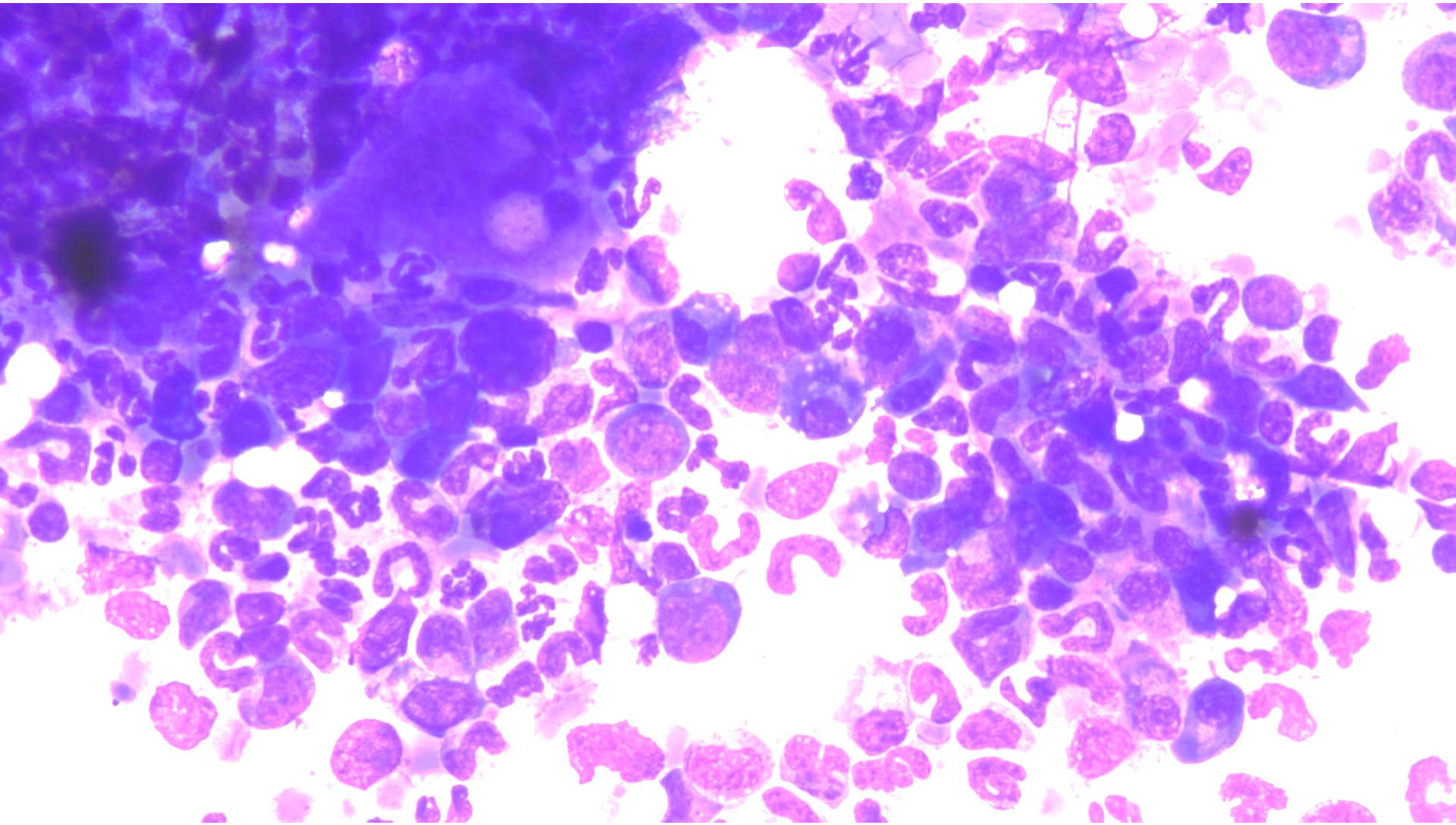
神秘案例: 貧血狀況的長期觀測

RBC型態:
非再生性貧血
Mild to moderate anisocytosis, sepherocytes +, poikilocytes +

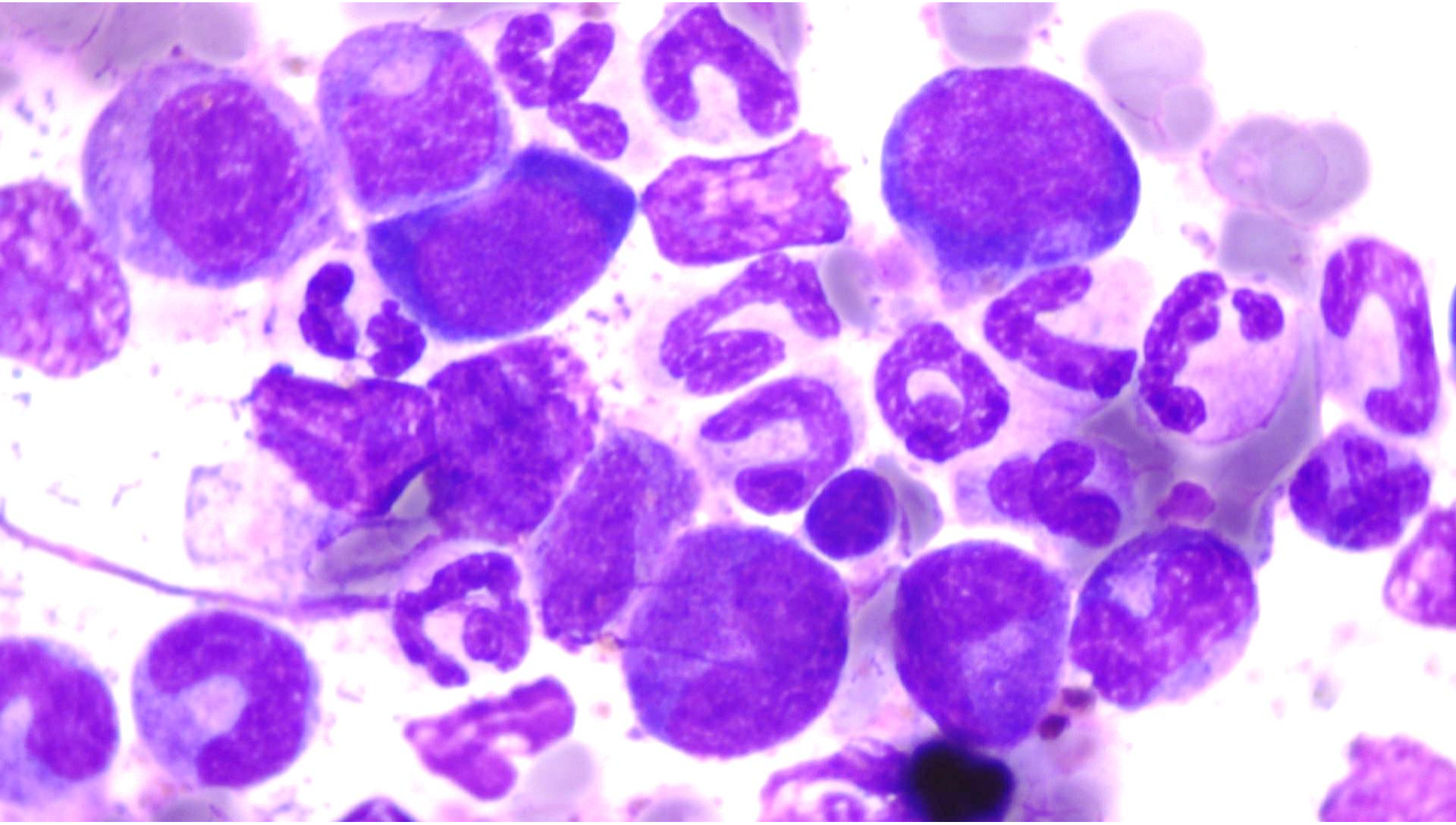


Blood Transfusion. May 8th Stopped giving cyclosporine. Mar 7th OHE

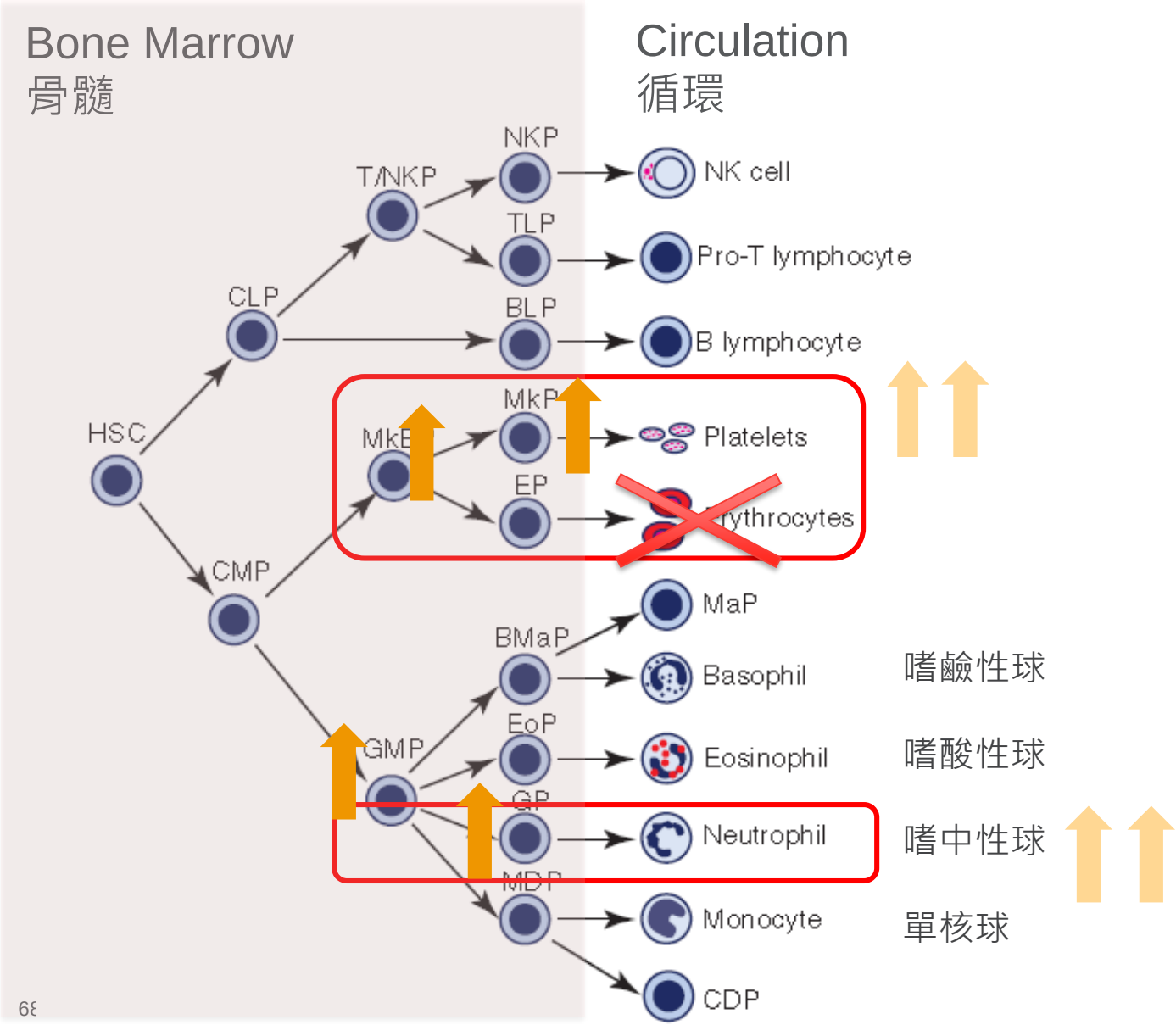
神秘案例 骨髓檢查發現



神秘案例 骨髓檢查發現



骨髓生成異常的狀況



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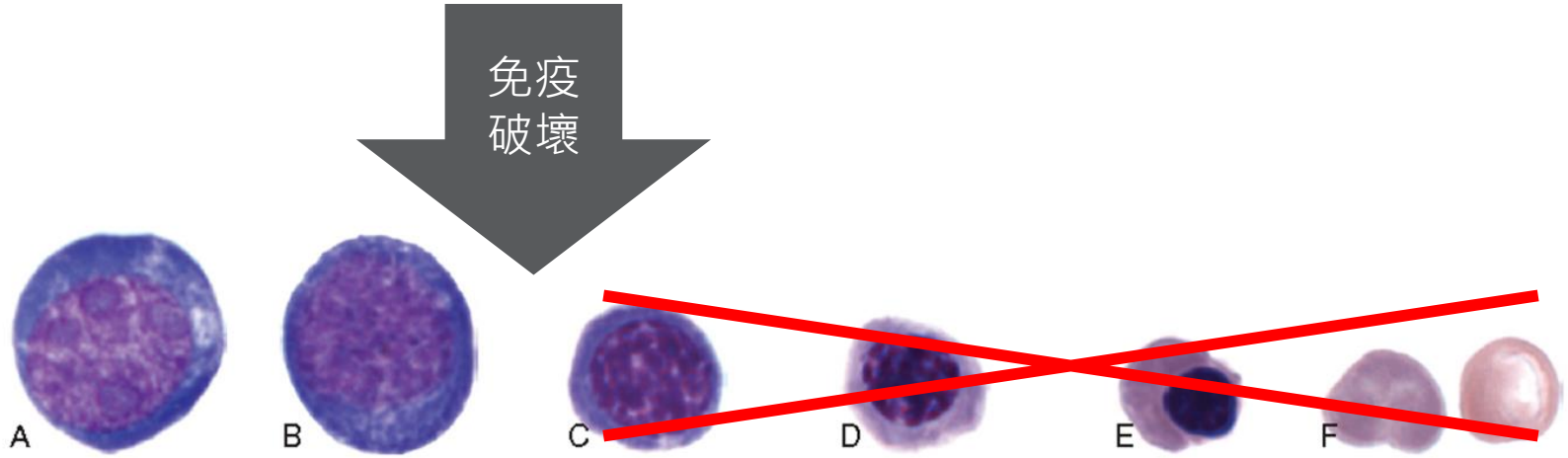
Pure Red Cell Aplasia 紅血球不生成症



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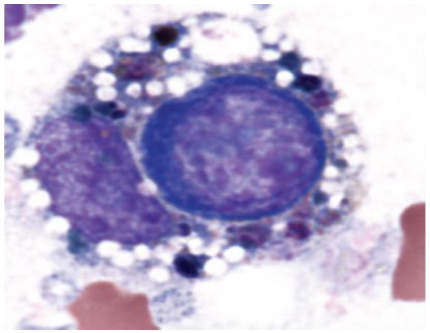
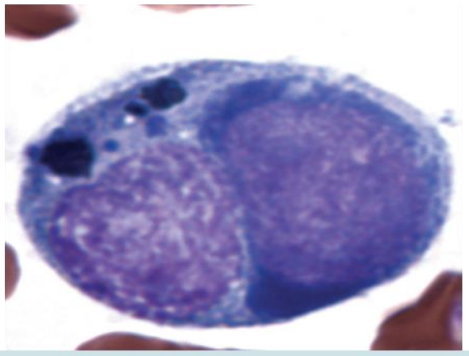
免疫抑制藥

輸血





造血細胞癌化 或 腫瘤轉移

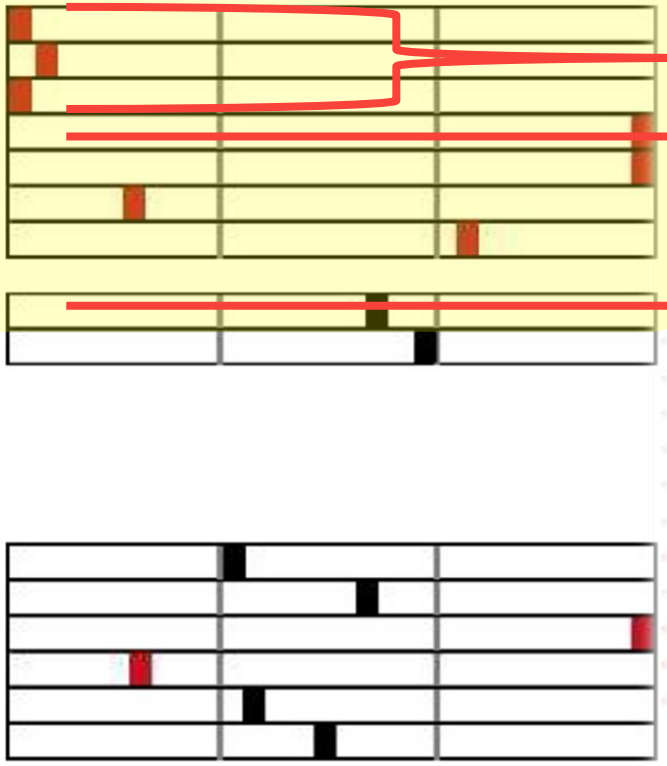
- 壓迫其他細胞在骨髓內的空間(長不出其他細胞)

- 血球無法正常的成熟(成熟度異常)
- 血球不受控的生長(增生)
- 壓迫其他細胞在骨髓內的空間(長不出其他細胞)

貓的反轉錄病毒感染

FeLV 、FIV 感染的貓，經常演變出骨髓病變，導致血液疾病。

Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx (2014年5月16日 下午5:30)					
RBC	*** 2.03 M/µL**	**6.54 - 12.20**	**低**		
HCT	*** 18.2 %**	**30.3 - 52.3**	**低**		
HGB	**4.9 g/dL**	**9.8 - 16.2**	**低**		
MCV	*** 89.7 fL**	**35.9 - 53.1**	**高**		
MCH	*** 24.1 pg**	**11.8 - 17.3**	**高**		
MCHC	*** 26.9 g/dL**	**28.1 - 35.8**	**低**		
RDW	*** 27.6 %**	**15.0 - 27.0**	**高**		
%RETIC	1.8 %				
RETIC	* 37.1 K/µL	3.0 - 50.0			
WBC	16.93 K/µL	2.87 - 17.02			
%NEU	12.5 %				
%LYM	29.5 %				
%MONO	57.1 %				
%EOS	0.6 %				
%BASO	0.3 %				
NEU	2.11 K/µL	1.48 - 10.29			
LYM	4.99 K/µL	0.92 - 6.88			
MONO	**9.67 K/µL**	**0.05 - 0.67**	**高**		
EOS	**0.11 K/µL**	**0.17 - 1.57**	**低**		
BASO	0.05 K/µL	0.01 - 0.26			
PLT	372 K/µL	151 - 600			



貧血

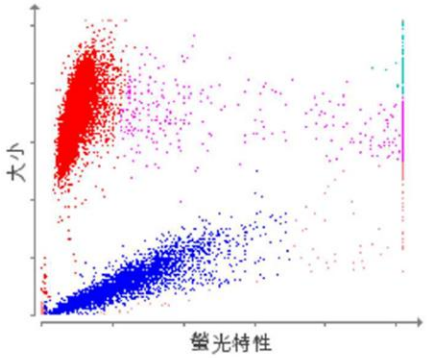
大球

非再生性

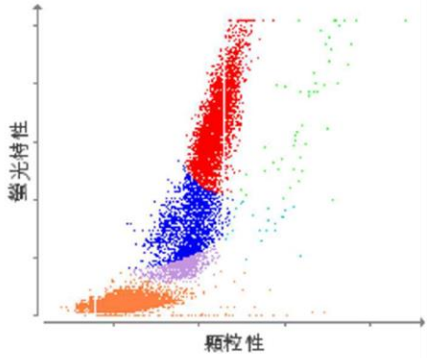
緊迫白血球相

紅血球單變分布

紅血球測試

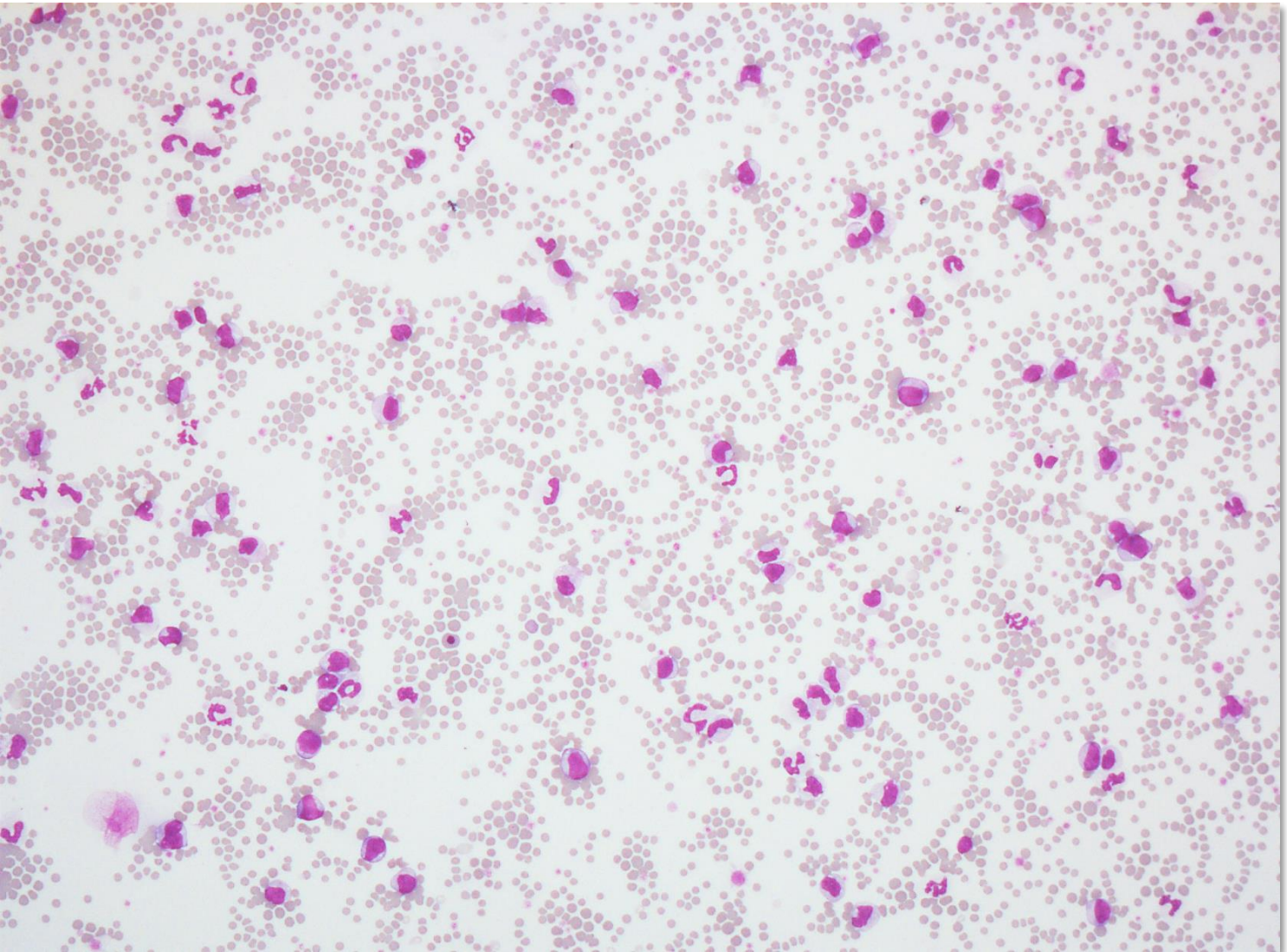


白血球測試



Happy: May 19 2014

持續貧血，白血球數量遽增。



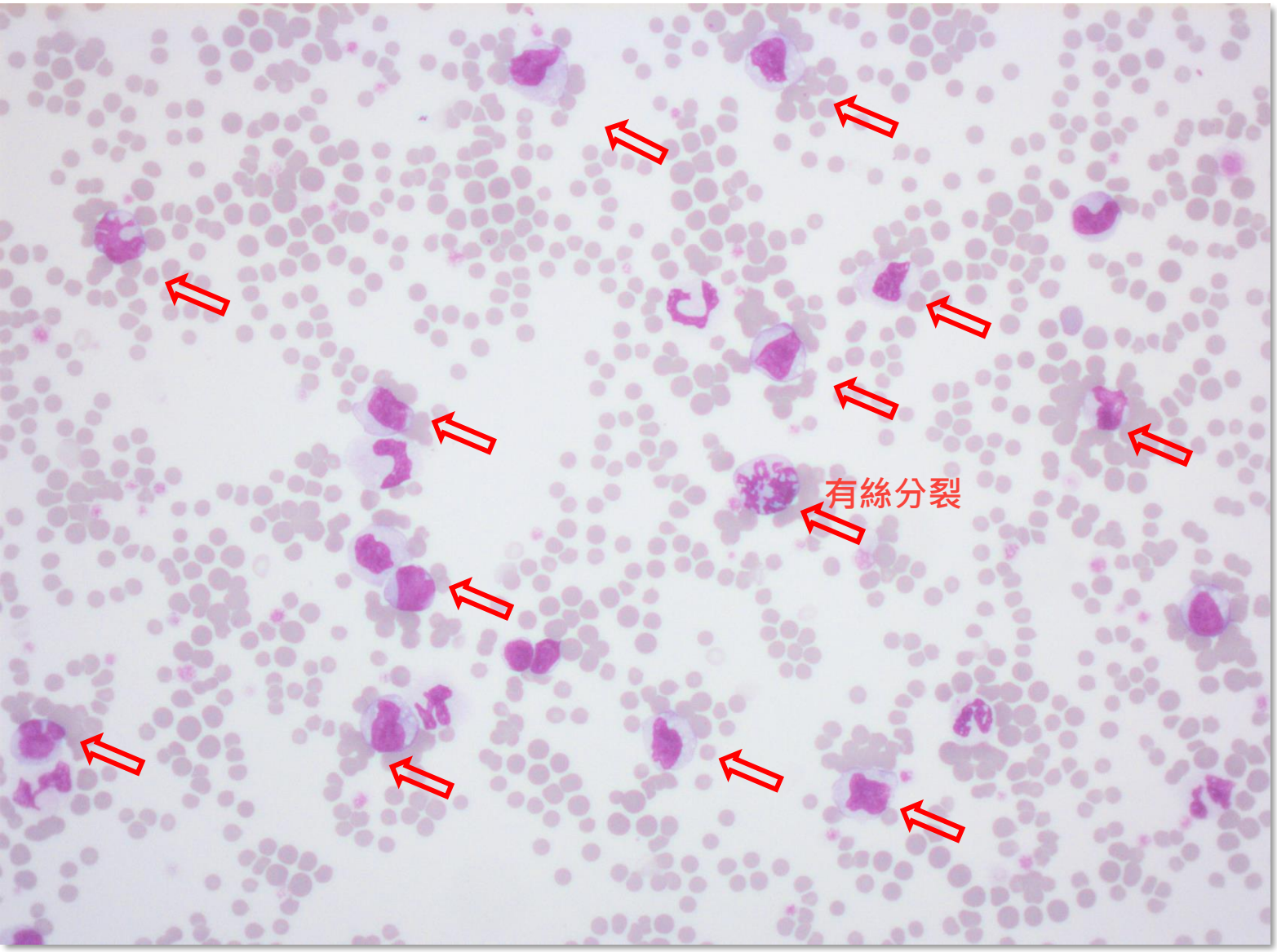
輸血兩日後

PCV: 22.9 %

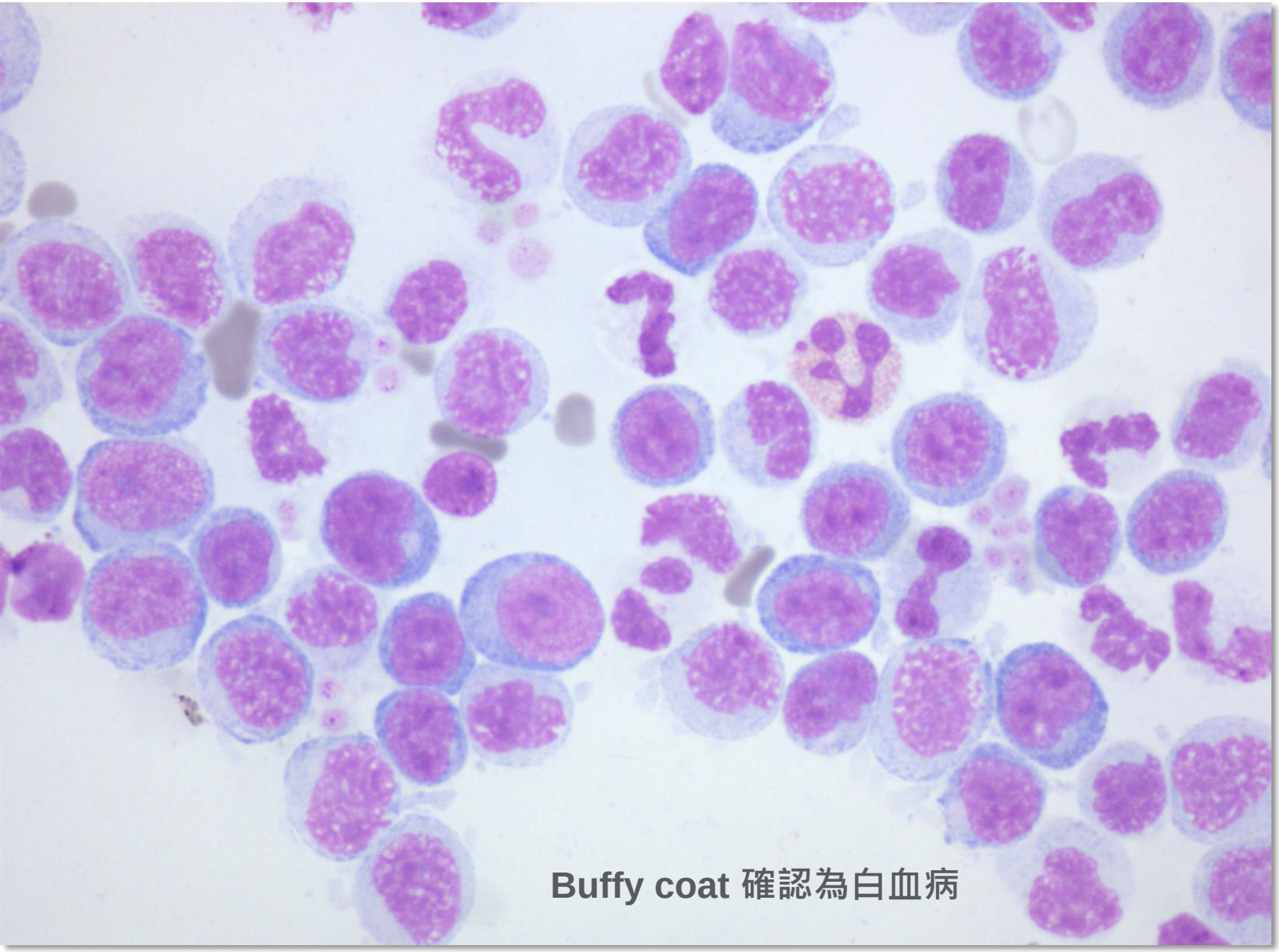
WBC: 41,800 /mm^3

Happy: May 19 2014

異常型態的白血球迅速增加，並出現有絲分裂。



Happy: May 19 2014



Happy: May 19 2014

- WBC↑
- PLT↓
- RET↓

持續非再生性貧血，白血球遽增為10.4 萬，血小板開始低下。

Test	Results	Reference Interval	LOW / NORMAL / HIGH	14-5-16 下午5:30
ProCyte Dx (2014年5月27日 上午11:22)				
RBC	2.27 M/μL	6.54 - 12.20 低		* 2.03 M/μL
HCT	13.7 %	30.3 - 52.3 低		* 18.2 %
HGB	4.0 g/dL	9.8 - 16.2 低		4.9 g/dL
MCV	60.4 fL	35.9 - 53.1 高		* 89.7 fL
MCH	17.6 pg	11.8 - 17.3 高		* 24.1 pg
MCHC	29.2 g/dL	28.1 - 35.8		* 26.9 g/dL
RDW	38.4 %	15.0 - 27.0 高		* 27.6 %
%RETIC	1.7 %			1.8 %
RETIC	39.0 K/μL	3.0 - 50.0		* 37.1 K/μL
WBC	104.62 K/μL	2.87 - 17.02 高		16.93 K/μL
%NEU	* 14.3 %			12.5 %
%LYM	* 36.9 %			29.5 %
%MONO	* 48.6 %			57.1 %
%EOS	0.1 %			0.6 %
%BASO	0.1 %			0.3 %
NEU	* 14.95 K/μL	1.48 - 10.29 高		2.11 K/μL
帶狀嗜中性球 (BAND)	* 疑似			
LYM	* 38.62 K/μL	0.92 - 6.88 高		4.99 K/μL
MONO	* 50.86 K/μL	0.05 - 0.67 高		9.67 K/μL
EOS	0.07 K/μL	0.17 - 1.57 低		0.11 K/μL
BASO	0.12 K/μL	0.01 - 0.26		0.05 K/μL
PLT	23 K/μL	151 - 600 低		372 K/μL

白血球異常分布

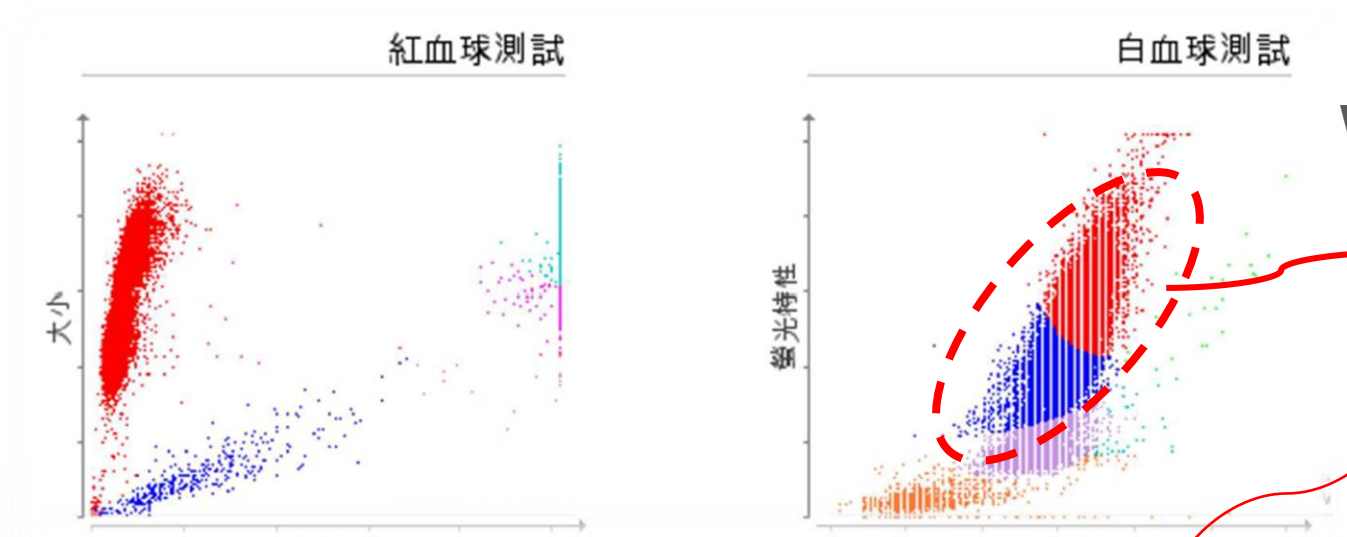
疑似有帶狀嗜中性球(BAND)

紅血球異常分布

Happy: May 19 2014

異常白血球快速增長

May 27



WBC: 104,620

異常白血球細胞
增加為十倍

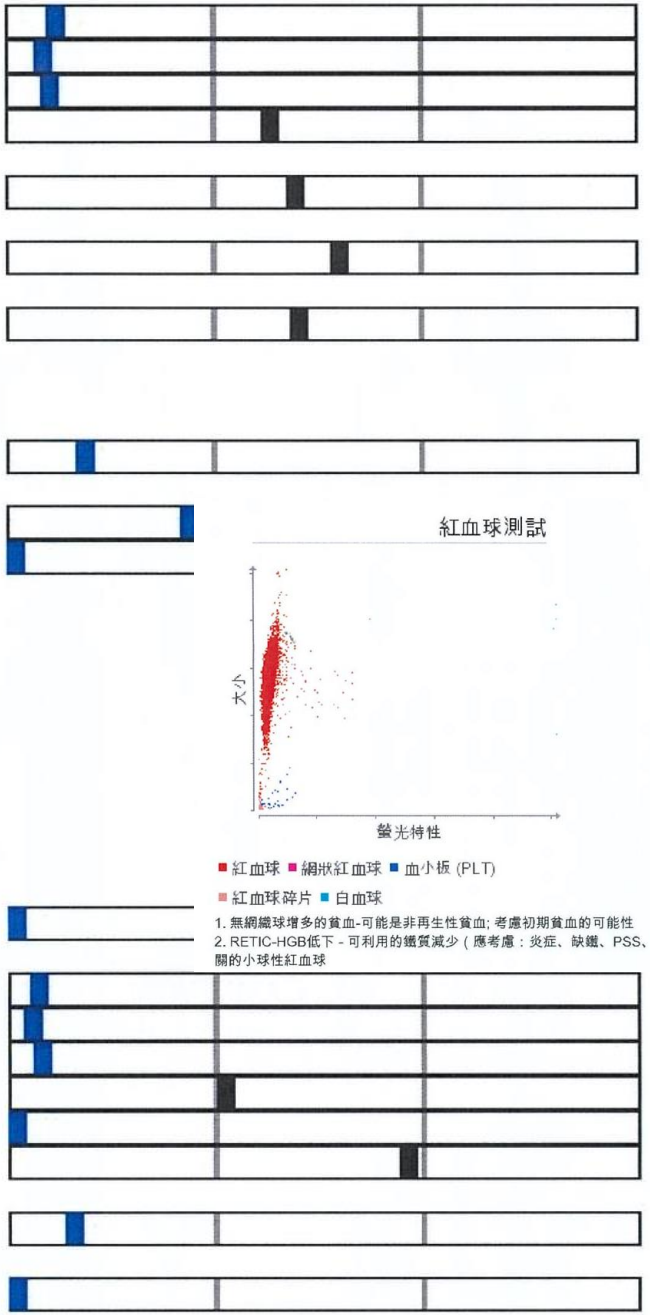
May 16

WBC: 16,930

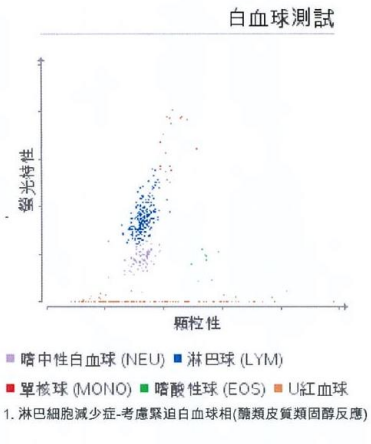
總結:

ProCyte Dx (2020年11月26日 下午 1:52)

紅血球	2.94 M/μL	5.65 - 8.87	低
血球容積比 (HCT)	19.1 %	37.3 - 61.7	低
血紅素 (HGB)	6.8 g/dL	13.1 - 20.5	低
平均紅血球體積 (MCV)	65.0 fL	61.6 - 73.5	
平均紅血球血紅素量 (MCH)	23.1 pg	21.2 - 25.9	
平均紅血球血紅素濃度 (MCHC)	35.6 g/dL	32.0 - 37.9	
紅血球分布寬度 (RDW)	17.0 %	13.6 - 21.7	
網狀紅血球百分比 (%RETIC)	0.1 %		
網狀紅血球 (RETIC)	3.8 K/μL	10.0 - 110.0	低
RETIC-HGB	20.9 pg	22.3 - 29.6	低
白血球	0.38 K/μL	5.05 - 16.76	低
嗜中性白血球百分比 (%NEU)	* 26.3 %		
淋巴球百分比 (% LYM)	* 65.8 %		
單核球百分比 (% MONO)	* 5.3 %		
嗜酸性球百分比 (% EOS)	* 2.6 %		
嗜鹼性球百分比 (% BASO)	* 0.0 %		
嗜中性白血球 (NEU)	* 0.10 K/μL	2.95 - 11.64	低
淋巴球 (LYM)	* 0.25 K/μL	1.05 - 5.10	低
單核球 (MONO)	* 0.02 K/μL	0.16 - 1.12	低
嗜酸性球 (EOS)	* 0.01 K/μL	0.06 - 1.23	低
嗜鹼性球 (BASO)	* 0.00 K/μL	0.00 - 0.10	
血小板 (PLT)	0 K/μL	148 - 484	低
平均血小板體積 (MPV)	12.9 fL	8.7 - 13.2	
血小板分布寬度 (PDW)	3.6 fL	9.1 - 19.4	低
血小板容積比 (PCT)	0.00 %	0.14 - 0.46	低



1. 無網織球增多的貧血-可能是非再生性貧血; 考慮初期貧血的可能性
2. RETIC-HGB低下 - 可利用的鐵質減少（應考慮：炎症、缺鐵、PSS、及品種相關的小球性紅血球



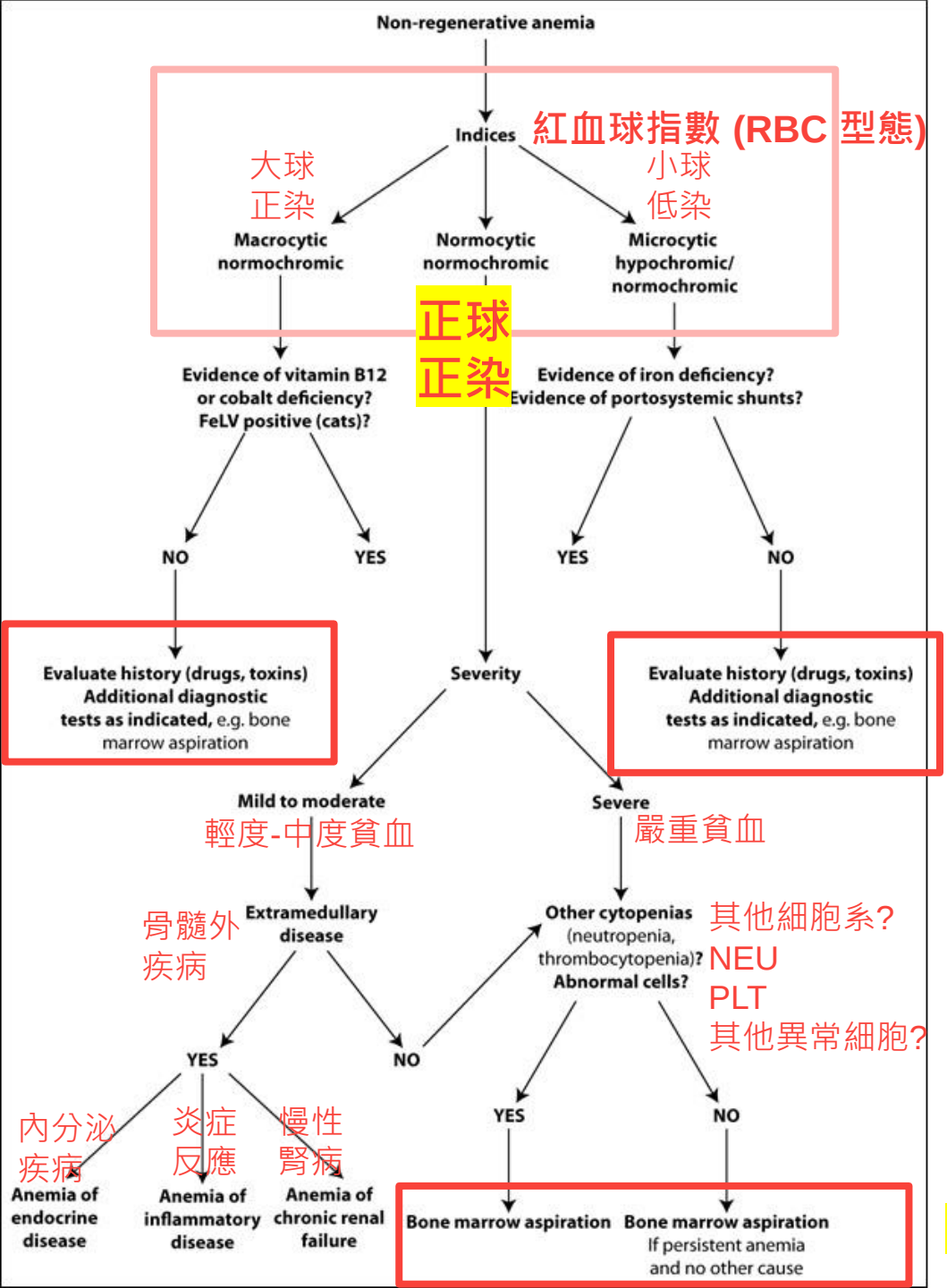
1. 淋巴細胞減少症-考慮緊迫白血球相(醣類皮質類固醇反應)

IDEXX

5.請問神秘案例2的血檢報告，哪一些發現讓你覺得可能有骨髓問題呢?(複選)

- 1. 白血球總數(WBC)
- 2. 嗜中性球(NEU)數量
- 3. 血小板(PLT)數量
- 4. 網織球(RET)數量
- 5. 血溶比 (HCT)
- 6. 嗜中性球(NEU) 核左轉
- 7. 我不知道捏…

區別診斷架構



骨髓採樣!!!!

https://eclinpath.com/hematology/anemia/causes-of-anemia/diagnostic-algorithm-nonregenerative-anemia/

骨髓採樣!!!!

善用網織球的資訊

1.幫助找到貧血的原因

2.決定治療的方向

3.評估預後

(嗜中性球)

感謝大家凝聽!!