Seksjonen er sponset av

TRIOLAB

MSD Animal Health

Torsdag 14. mars

Program for Smådyr

Coagulation abnormalities–Diagnostic approach

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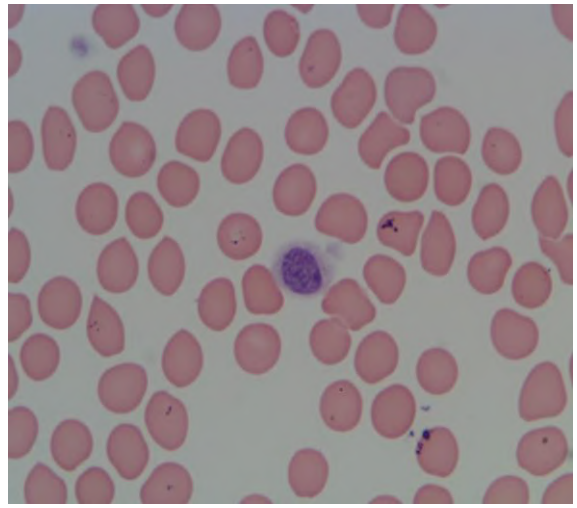
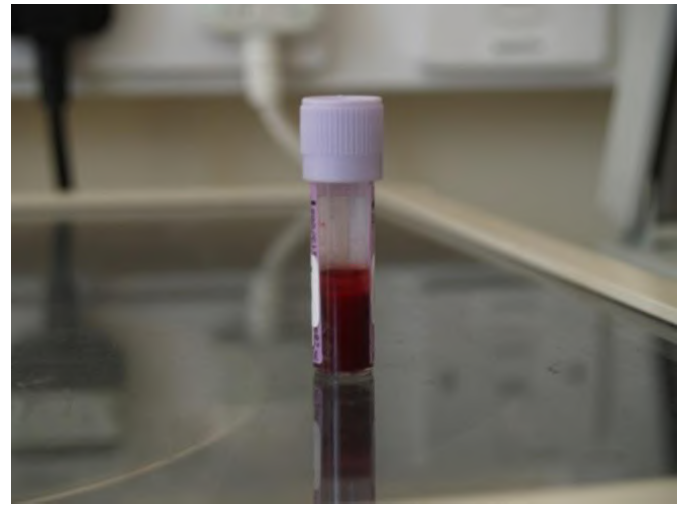




Content

- **Clotting – Some definitions**
- **Clinical aspects - Why do we do test?**
- **The In-clinic Laboratory – Diagnostics**
- **Coagulation abnormalities - Causes**
- **Summary - Quiz**

CLOTTING (HAEMOSTASIS) -DEFINITIONS

- Haemostasis is a complex process involving the vessel wall, platelets and coagulation proteins (= clotting factors; synthesised in the liver).

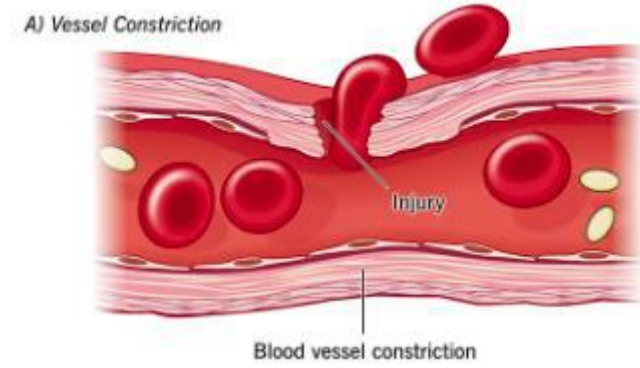
- Injury to vessel wall leads to two main events
  - involving the vessel wall, platelets (**PRIMARY Haemostasis**)
  - the coagulation proteins (**SECONDARY Haemostasis**).

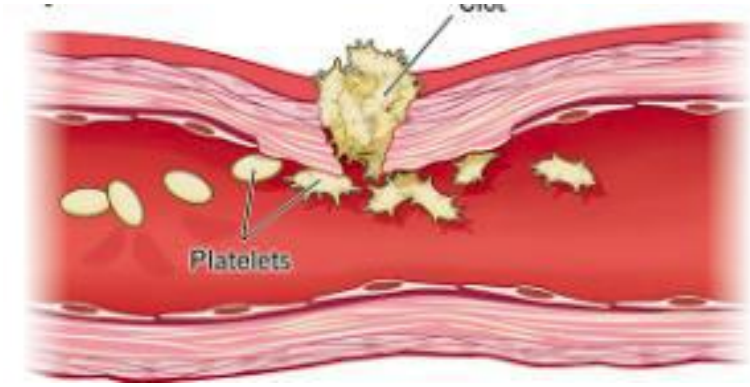
- The end product of haemostasis is a solid clot composed of **fused activated platelets** surrounded **by a mesh of fibrin strands**.

- Excessive clot formation is prevented by FIBRINOLYSIS
  - is the breakdown of fibrin within the blood clots (**TERTIARY Haemostasis**)

Haemostasis

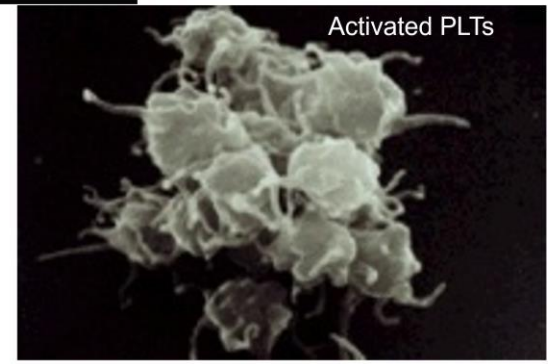
- **Primary haemostasis**
  - Vasoconstriction
  - Platelet activation
  - Formation of platelet plug



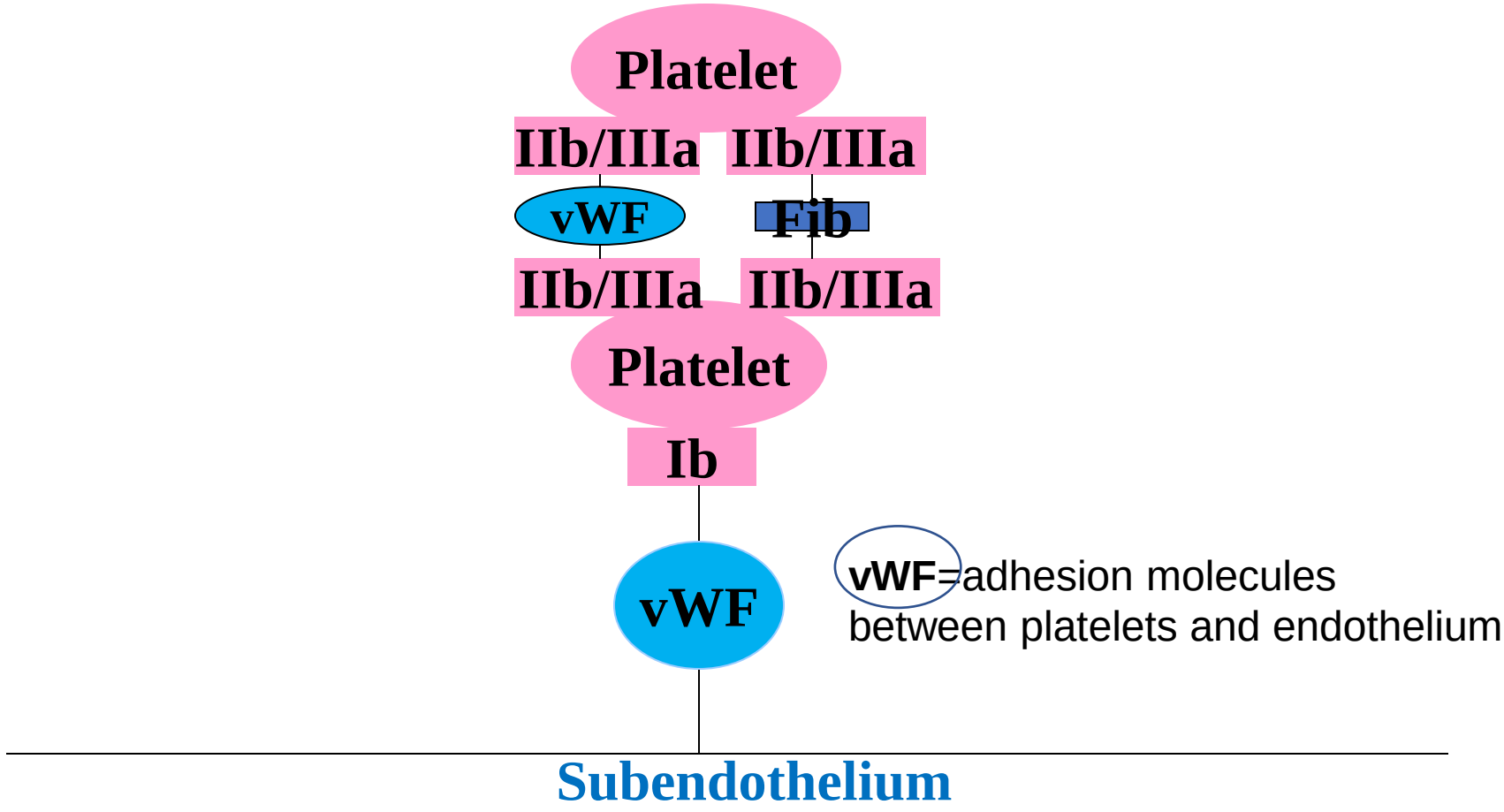


Normal platelets in circlation

Exposure of pseudopods on the outer platelet membrane provides the surface for coagulation factor assembly

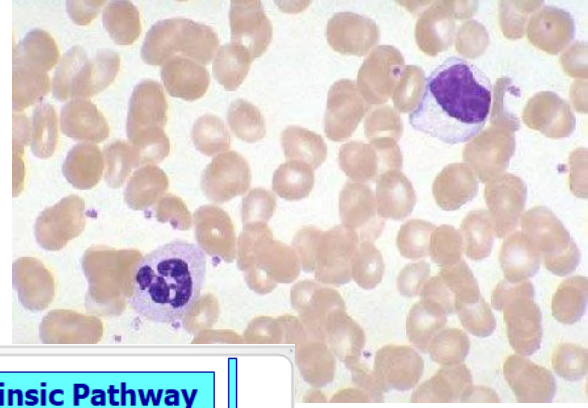


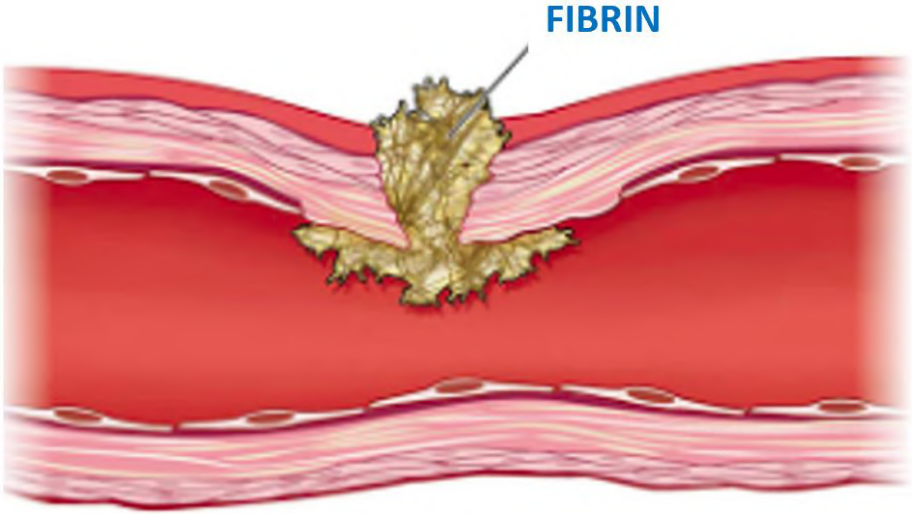
Activated platelets adhere to each other and on the endothelium with vWF molecules

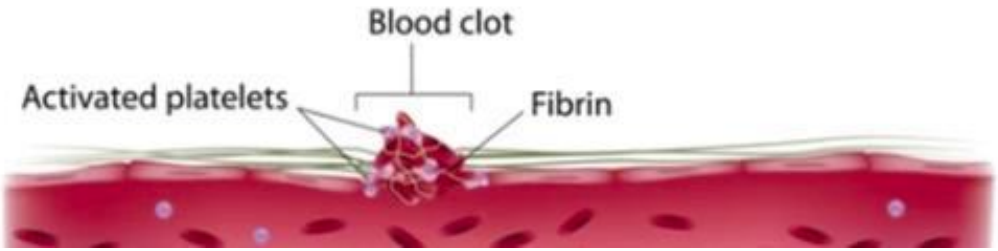


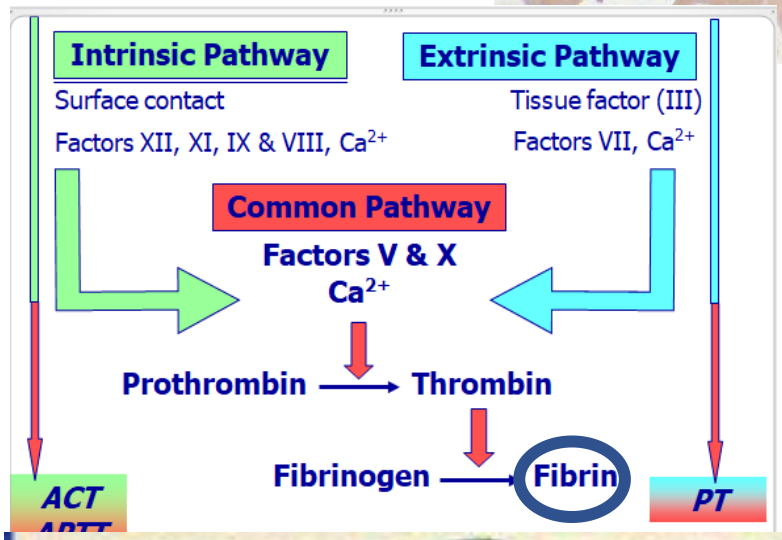
Haemostasis

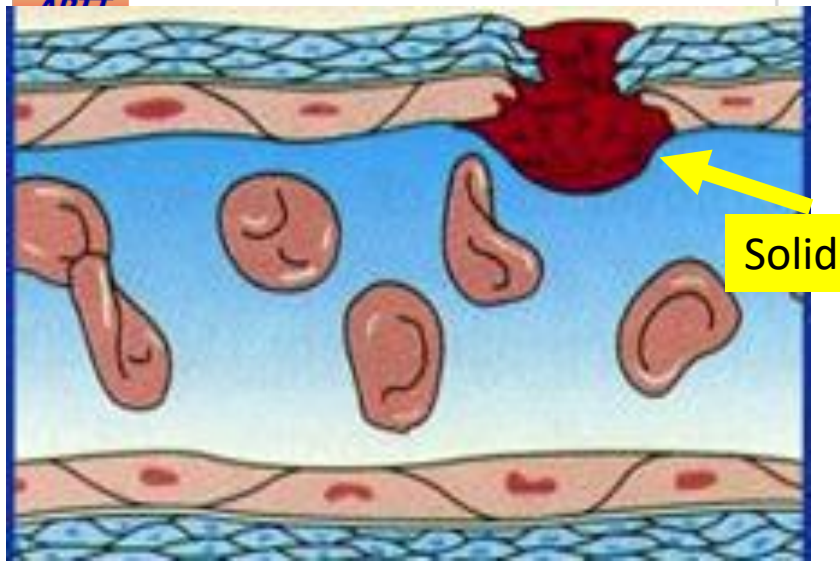
- **Secondary haemostasis**
  - Coagulation cascade results in FIBRIN SOLUBLE clot



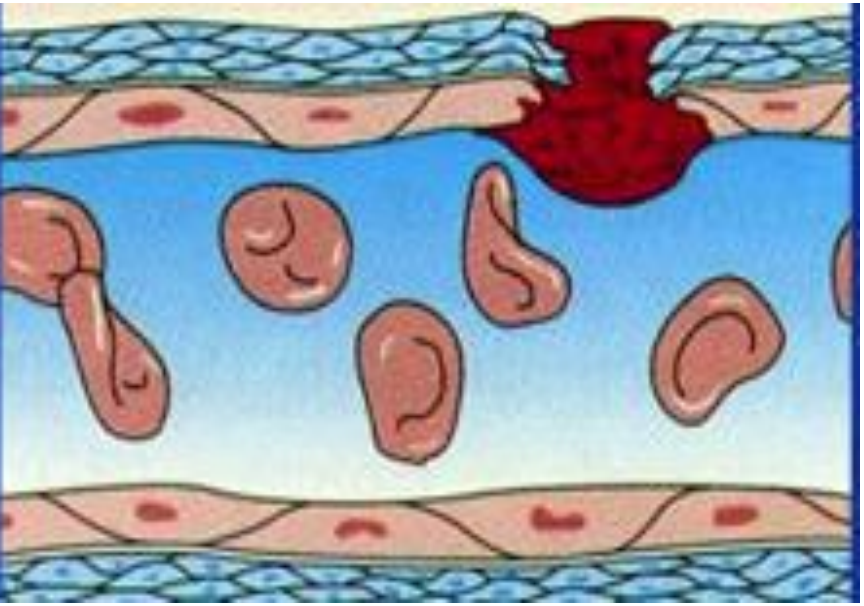


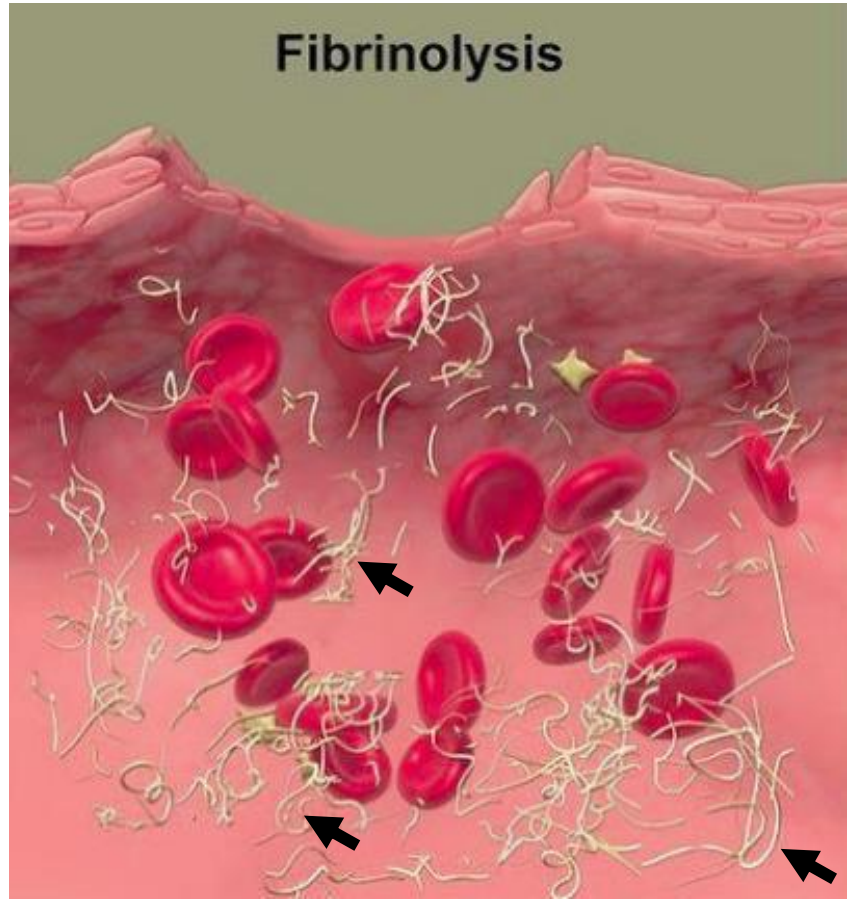






Once injured endothelium is repaired

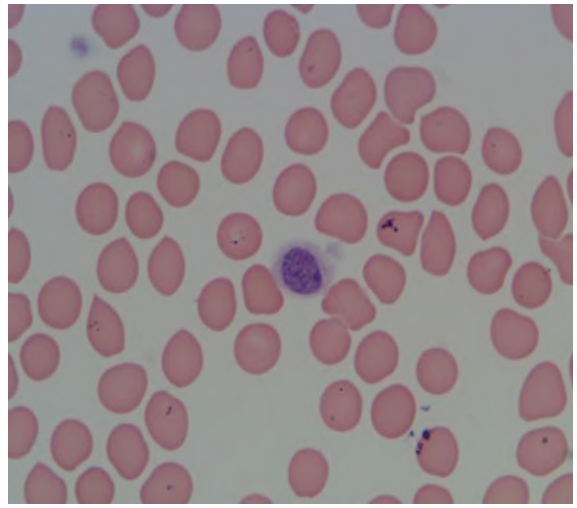


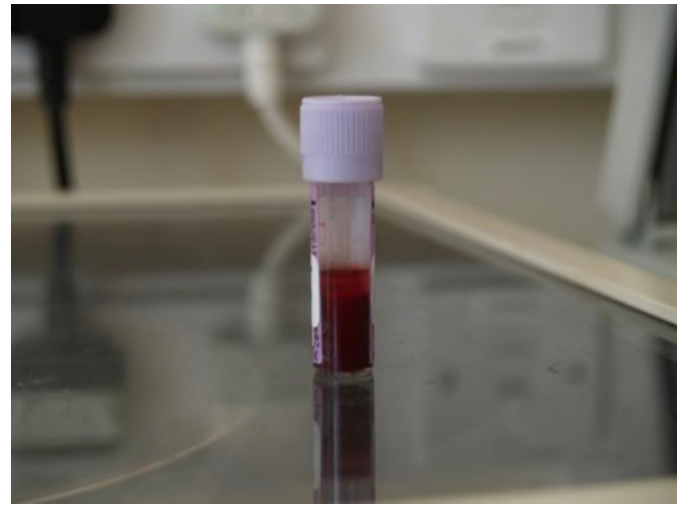


Clot retraction

Breakdown of Fibrin

Fibrin fragments





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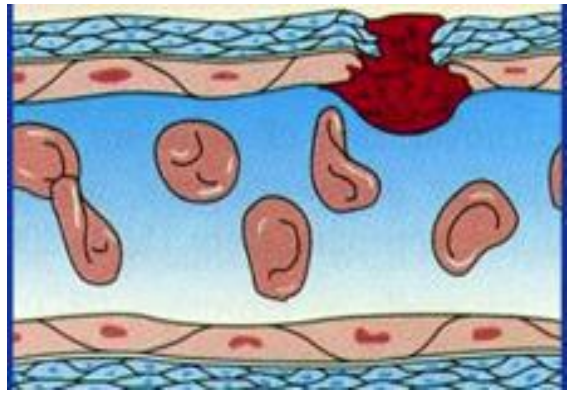
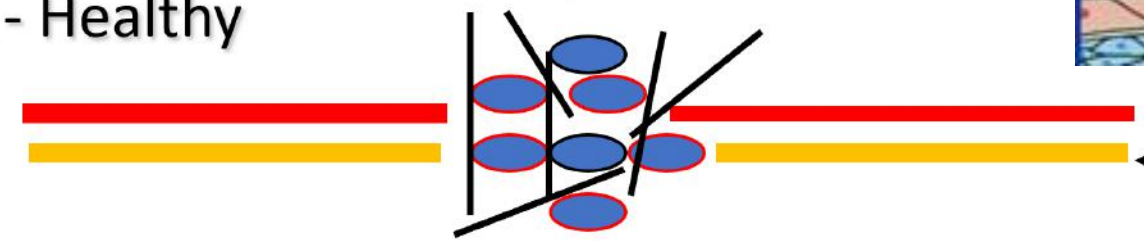
Clinical presentation



Fibrin-platelet plug

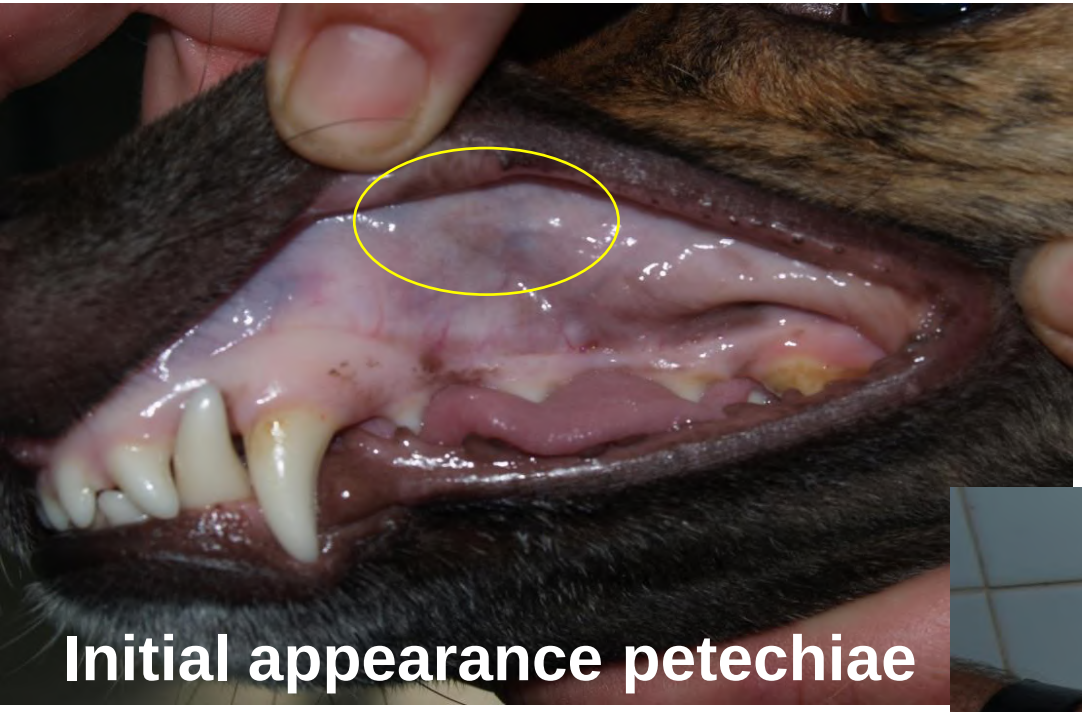
NORMAL - Healthy



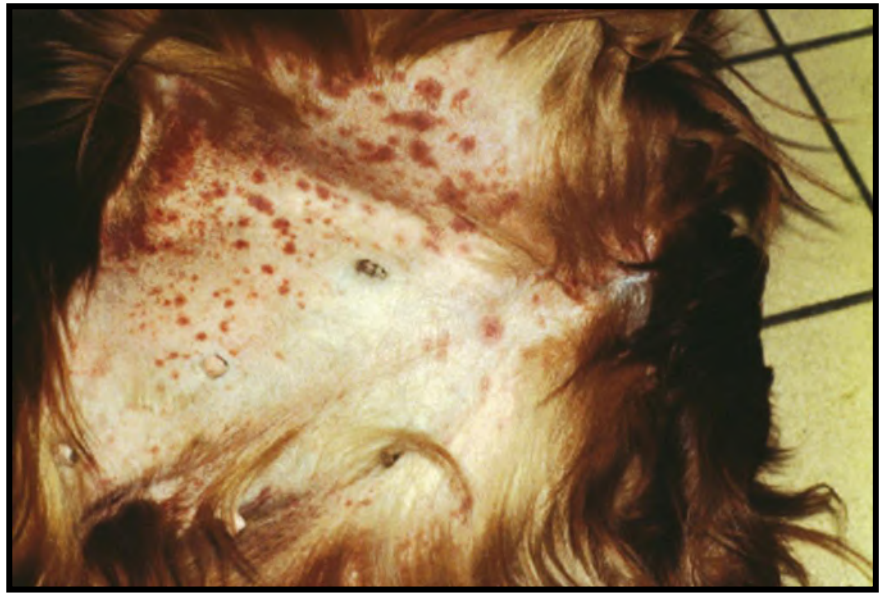
A. Primary haemostatic disorder
(**No** platelets or **No** platelet adherence)

Fibrin soluble clot/mesh of fibrin strands only present = Petechia

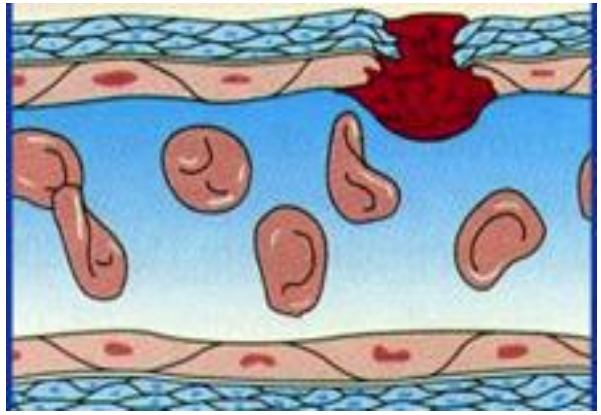
Primary Haemostatic disorder = Petechiation-Ecchymosis



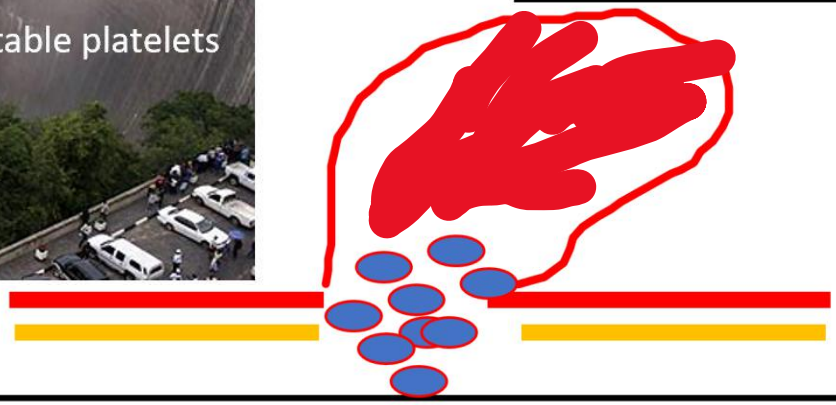
Petechiation-Ecchymosis



Clinical presentation

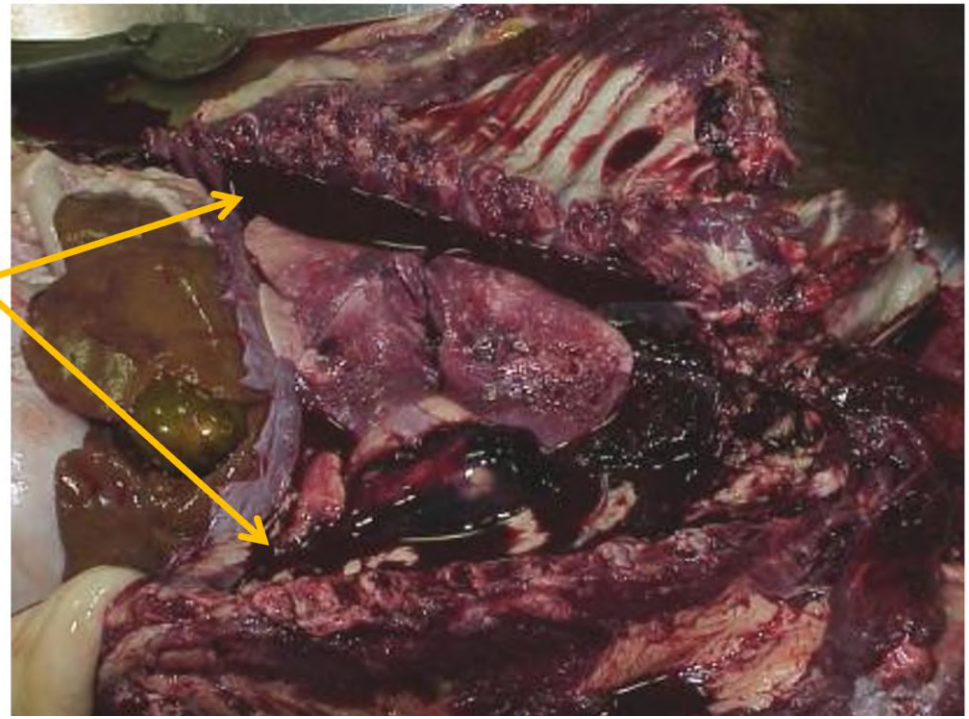


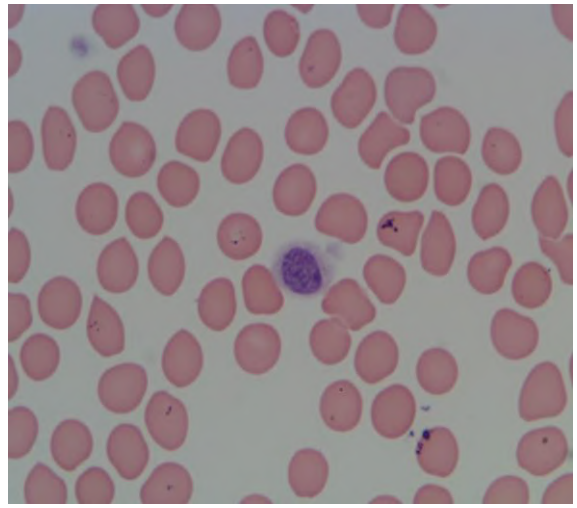
Broken unstable platelet plug leads to **Haematoma/Haemorrhage**

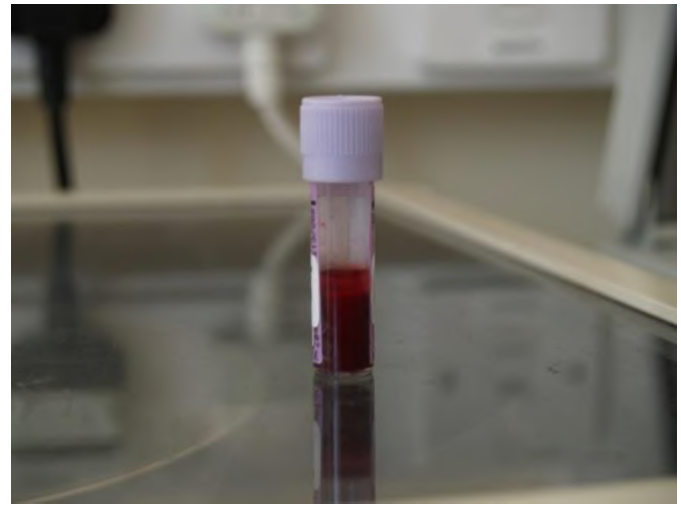


B. Secondary haemostatic disorder >> **No** clotting factors >> **No** fibrin >> Unstable clot

Secondary haemostatic disorders = Large cavity bleeds/Re-bleeding /Haematomas /Haemorrhage







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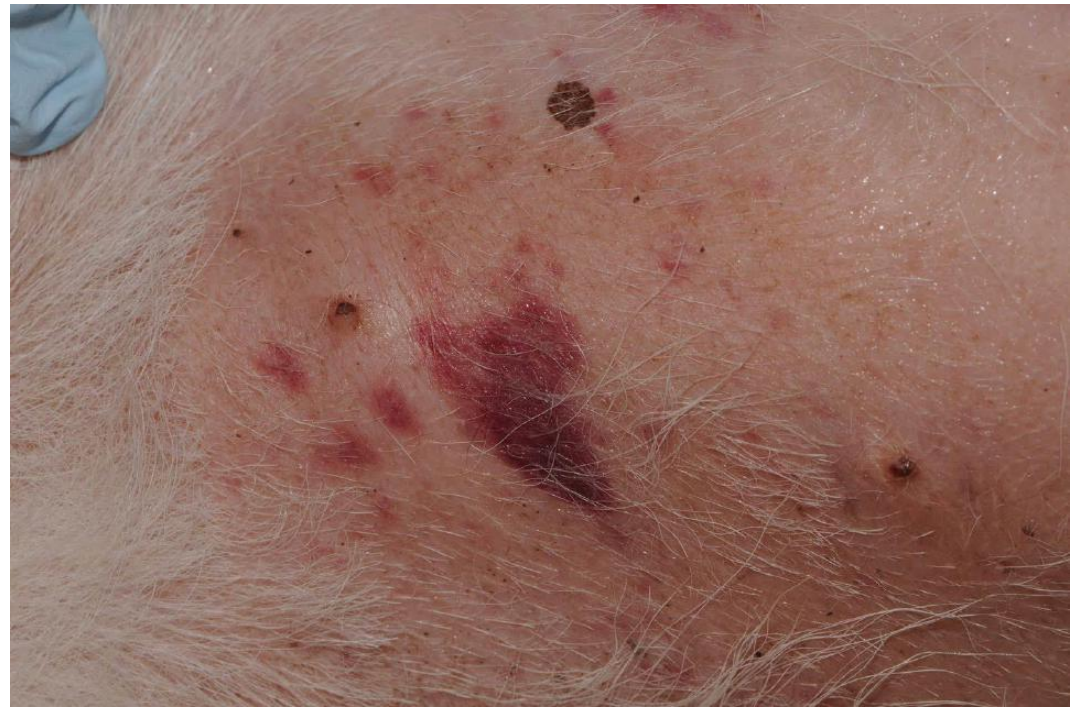
Thrombocytopenia

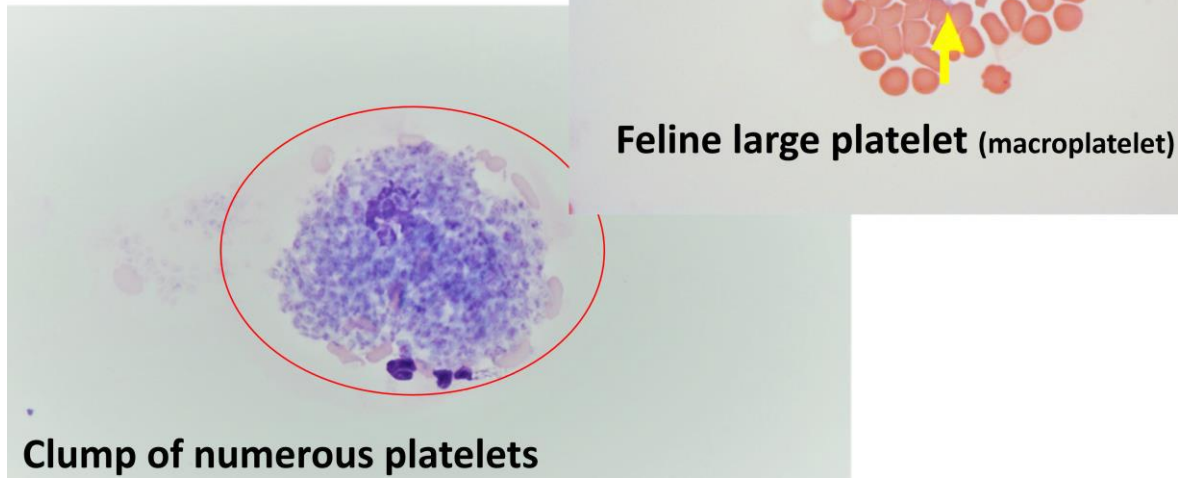


Thrombocytopenia

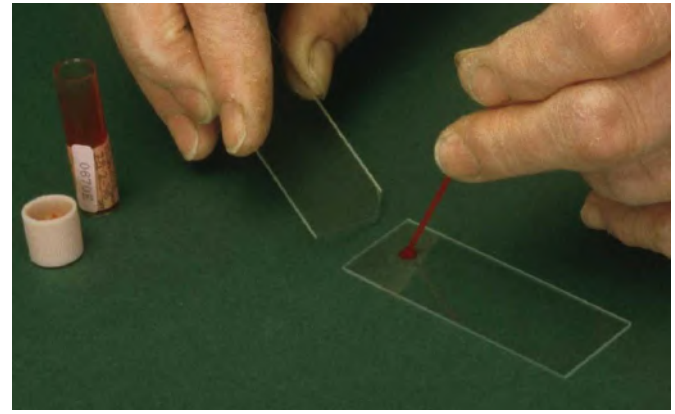
- Platelet count can be determined:
  - *In-clinic haematology analysers*

SmplD				1375
PatID				E02973E
Name				
Mode				Dog
Sex				---
Doctor				
Test date				11.02.2021 01:49 PM
Report date				11.02.2021 01:49 PM
S/N				250623
WBC	7.29	10^9/l	5.3	20
LYM	1.23	10^9/l	0.5	4.8
MON	0.01-	10^9/l	0.1	1.5
NEU	5.98	10^9/l	2.7	11.9
EOS	0.07	10^9/l	0	1
BAS	0.01	10^9/l	0	0.2
LY%	16.9	%	16.6	35.6
MO%	0.2-	%	2	4
NE%	82.0+	%	53.4	73.5
EO%	0.9-	%	1	10
BA%	0.1-	%	0.1	2
RBC	5.51	10^12/l	5.3	7.9
HGB	11.1-	g/dl	12.4	21.1
HCT	33.12-	%	37.5	58.9
MCV	60-	fl	62.2	77
MCH	20.2-	pg	22.8	28.3
MCHC	33.5	g/dl	33.5	39
RDWc	19.8	%		
PLT	88-	10^9/l	200	500
PCT	0.11	%		
MPV	12.2+	fl	3.9	11.1
PDWc	42.4	%		

EDTA tube

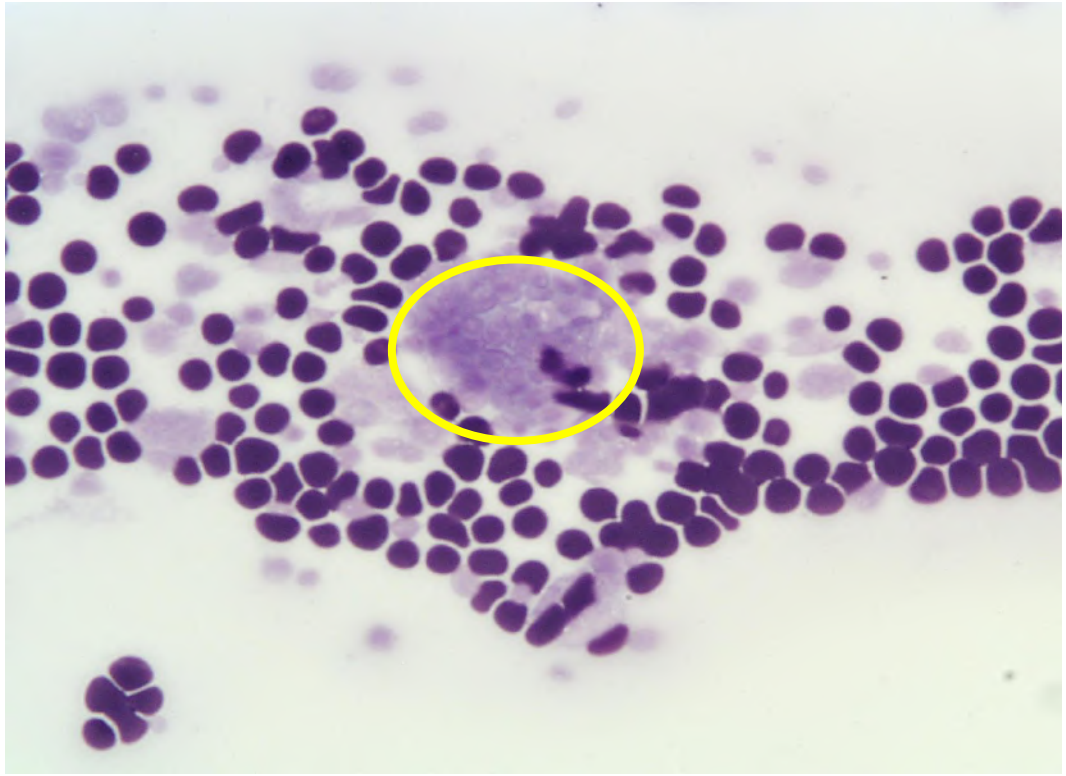


- *The analysers commonly report thrombocytopenia which is "false"*
  - *Platelet clumping – clumps are counted as white blood cells or not counted at all*
  - *Platelet size overlap with RBC size in the cat and platelets can be counted as erythrocytes*



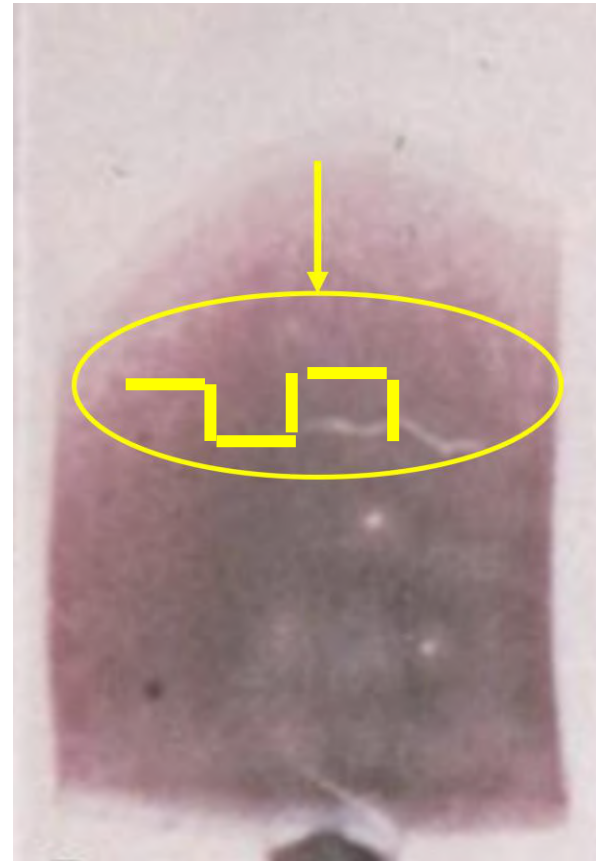
Manual platelet count estimation: Step 1

- Examine the feathered edge on x20 lens
  - Platelet clumps ? (if present, likely false thrombocytopenia)
  - Dirofilaria ? (Bonus finding if there ☺)



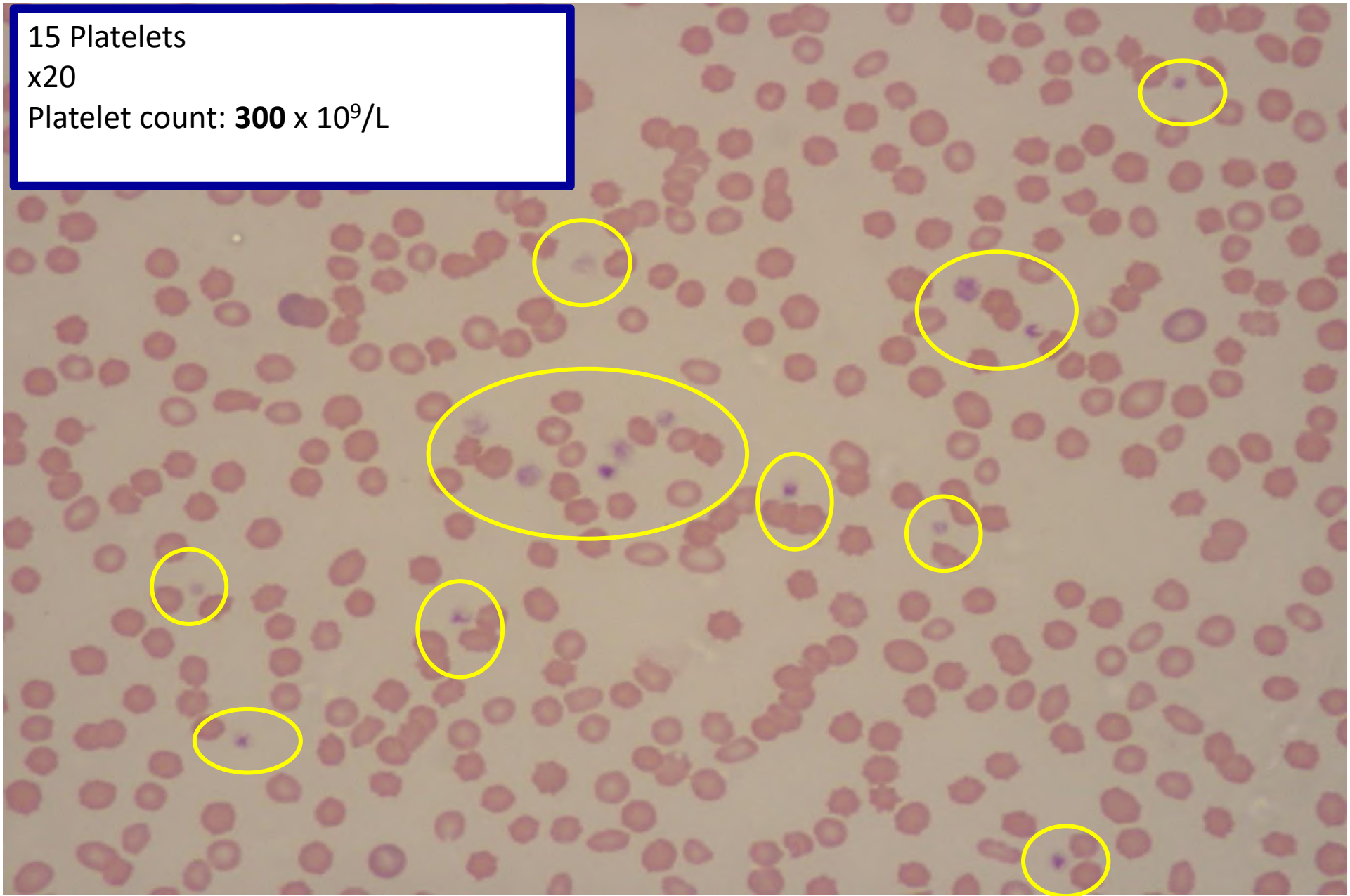
Step 2

- MONOLAYER
- x1000 magnification (x100 oil lens)
- Count platelets in 10-20 fields
- Calculate the mean number of platelets



CAT: Multiply Mean number x 20 = Total number ($x10^9/L$)
DOG: Multiply Mean number x 15 = Total number ($x10^9/L$)

BSH, 7yo, “Gunner” (RI Platelets=200–700 x 10^9/L)



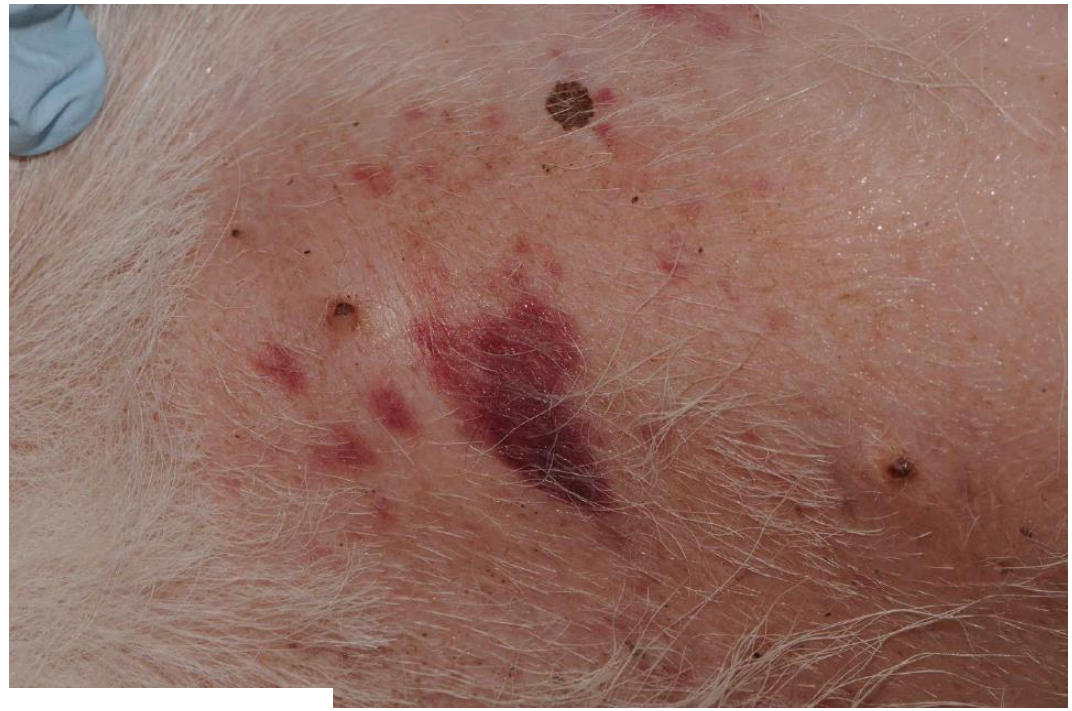
A. Primary haemostatic disorder
(**No** platelets or **No** platelet adherence)

Fibrin soluble clot/mesh of fibrin strands only present = Petechia

Thrombocytopenia

- Decreased production
  - Bone marrow dz
  - Drugs, FeLV/FIV
- Loss/Sequestration
  - Blood loss
  - Sequestration in spleen
- **Increased utilization**
  - DIC, vasculitis
- **Destruction**
  - Immune mediated

Most common causes



A. Primary haemostatic disorder
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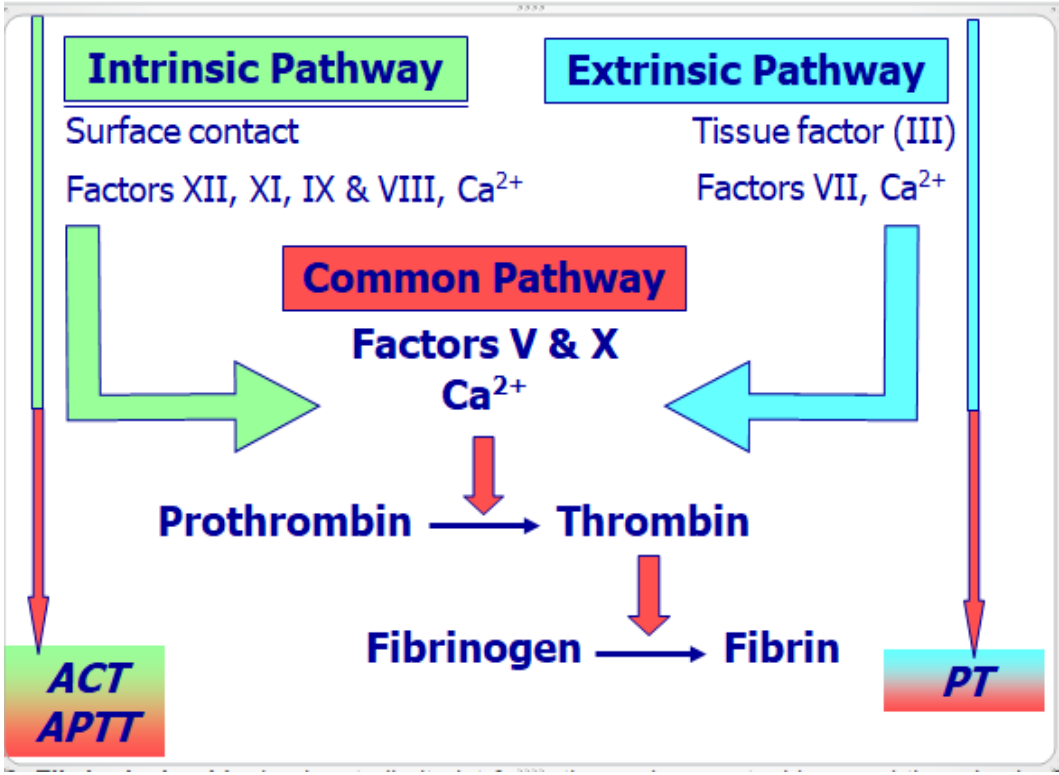
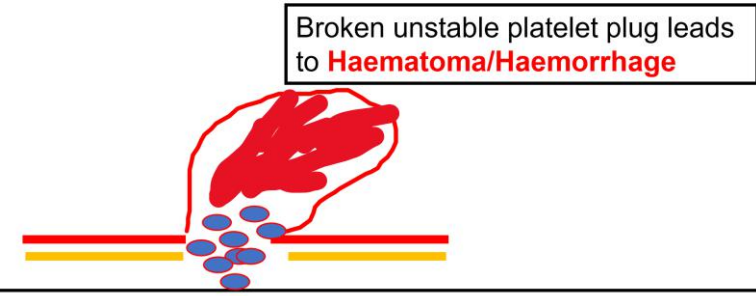
Thrombocytopathy

1. No formation of stable platelet plug
2. No vW factor
3. Vessel wall abnormalities

1. No formation of stable platelet plug = Buccal mucosal bleeding time (BMBT) (Platelet function test)

- Do NOT perform in cases with thrombocytopenia
- Healthy dog: **< 5 mins**
- Healthy cat (sedated with ketamine/ACP): **<3.5 mins**
- Prolonged with
  - Thrombopathia
  - **vWD (<20% Ag)**
- Useful presurgical screen for breeds at risk of vWD





B. Secondary haemostatic disorder >> **No** clotting factors >> **No** fibrin >> Unstable clot

1.Lab tests to evaluate clotting factor activity

Activated clotting time (ACT)
Prothrombin time (PT or OSPT)
Activated partial thromboplastin time (APTT)

PROLONGATION OF TIMES >> DECREASED FACTOR ACTIVITY

2.Lab tests to measure individual clotting factors

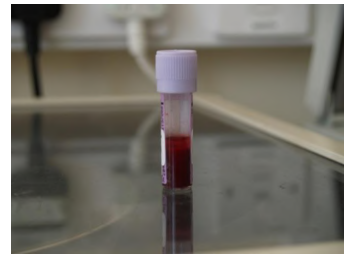
Lab tests to evaluate clotting factor activity

Activated clotting time test (ACT)

- Time taken for whole blood to clot
  - in-house test
  - In both cats and dogs, a MAX-ACT result >85 seconds is considered abnormal
  - Further coagulation testing should be performed

Measurement of PT, APTT

- Sodium citrate tube
- FILL TUBE UP TO THE LINE
  - Crucial: no clots



- <u>Use an External Lab</u>
  - *Separated citrate plasma*
  - Transfer plasm into PLAIN tube – Label tube "Citrate plasma"
  - should arrive to lab not later than 24 hrs post collection
  - If not possible, FREEZE PLASMA(-20°C)

- <u>Point-of-care (POC) analysers</u>
  - Published clinical studies available

Point-of-Care (POC) Coagulometers

SCA2000™

Measures APTT and PT
Studies only for dogs

	Normal results	Prolonged results
PT	Reliable	Reliable
APTT	Reliable	Inconsistent – Require confirmation with a reference method

Coag Dx™

Measures APTT and PT
Studies only for dogs

	Normal results	Prolonged results
PT	Reliable	Reliable
APTT	Reliable	Unreliable

Amax Destiny Plus

Measures APTT and PT
Study only for dogs

	Normal results	Prolonged results
PT	Reliable	Reliable
APTT	Reliable	Reliable

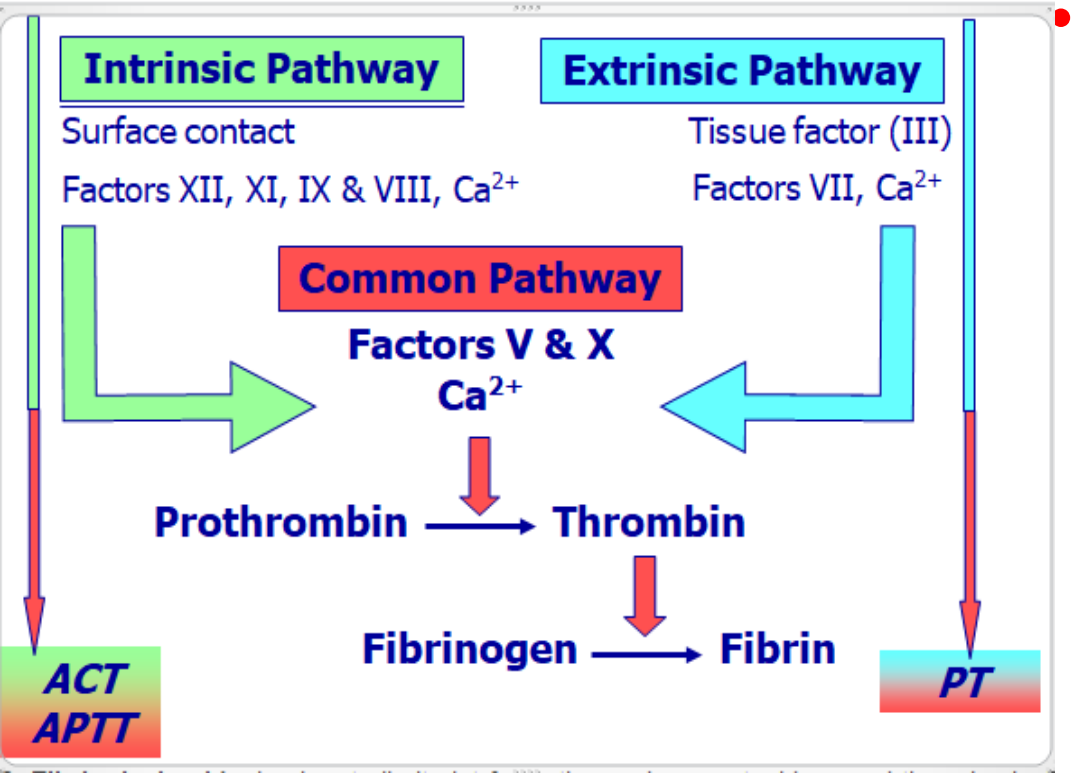
CoaguChek-XS

Measures only PT
Studies for dogs & cats

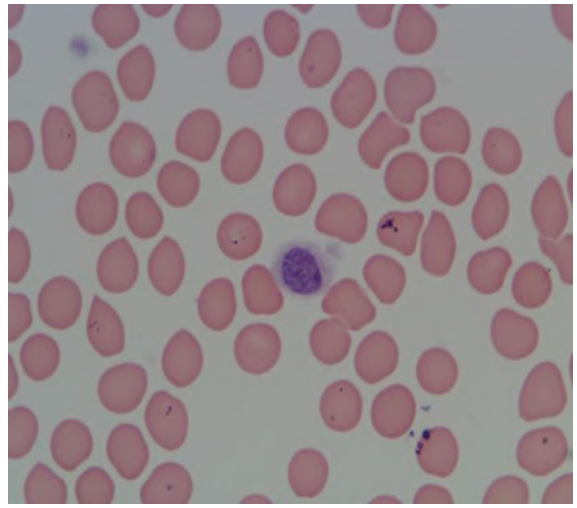
	Normal results	Prolonged results
PT	Reliable	Unreliable - Require confirmation with a reference method

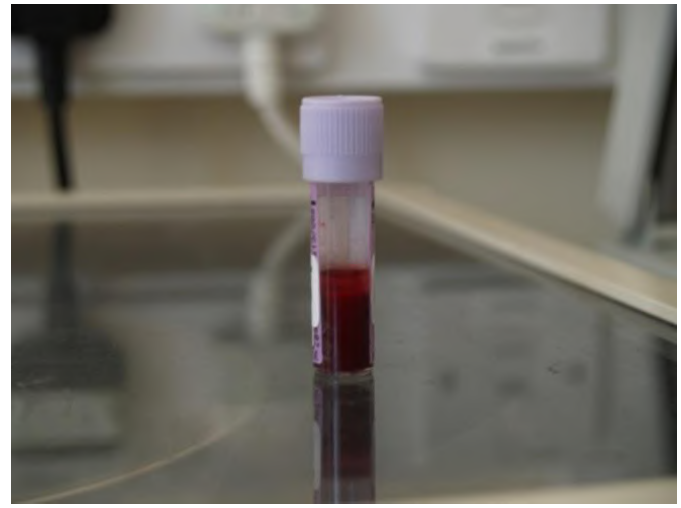
Causes for prolonged PT and/or APTT/ACT

- Prolongation of times more than 30% of normal control considered clinically significant BUT also needs comparing to reference interval.



- **Inherited factor deficiencies**
  - e.g fVIII/IX def (Haemophilia A/B)
  - Cats: fXII (Hageman) def (prolonged APTT/ACT but does not result in bleeding; no Tx required)
- **Acquired (most common)**
  - **Vit K inactivation or deficiency**
    - Vit K activates f II, VII, IX, X
    - Most common cause of Vit K deficiency
      - **Rodenticides**
  - Liver disease
  - *Angiostrongylus infection*
  - *FIV infection (prolonged APTT; unknown pathomechanism)*





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- **PRIMARY HAEMOSTATIC diseases**
  - Platelets, Blood vessel wall
  - Thrombocytopenia, Thrombocytopathy/vWf, Blood vessel wall abnormalities
  - Superficial, small haemorrhages-petechial, ecchymosis
  - Laboratory diagnostics
    - Platelet count (EDTA blood sample, Blood smear, Haematology analyser)
    - If animal is not THROMBOCYTOPENIC then consider
      - Thrombocytopathy (*Buccal mucosal bleeding test*)
- **SECONDARY HAEMOSTATIC diseases**
  - Deficiency/No activation of one or more Clotting Factors (CF; coagulation proteins)
  - Inherited CF deficiency, Liver failure, Vitamin K deficiency/antagonism (anticoagulant rodenticide toxicosis), Systemic diseases/infections causing DIC
  - Large haemorrhages, Haematomas
  - Laboratory diagnostics
    - ACT, PT, APTT (prolongation of times indicates secondary haemostatic disease)
    - External Veterinary Referral Lab (Separated Citrate Plasma, arrive within 24 hrs post collection) – **Reliable results**
    - Point-of-Care coagulometers (POC) (In-clinic Lab) (Citrate whole blood or Citrate Plasma)
      - PT/APTT results within normal limits overall reliable; **Prolonged results can be inaccurate**

Tusen takk!

Har du noen spørsmål?

Seksjonen er sponset av

TRIOLAB

MSD Animal Health

Torsdag 14. mars

Program for Smådyr